

400 Series Professional Work Station

Operation and Maintenance Instructions

520-05656 11/96

400 Series Professional Work Station

Operation & Maintenance Instructions

Table of Contents

Chapter 1: Introduction

| | | | |
|--|------|--|------|
| Safety Precautions | 1-3 | Trigger Lead | |
| Personal Safety | 1-3 | Screen Components | 1-20 |
| Ventilation | 1-3 | Changing Trigger | 1-20 |
| Fuel Systems | 1-3 | For Conventional Systems | 1-20 |
| Batteries | 1-4 | For DIS Vehicles | 1-20 |
| Personal Safety | 1-4 | Icon Index | 1-21 |
| About the Manual | 1-6 | Use and Care | 1-22 |
| Conventions and Definitions | 1-7 | Special Computer Precautions | 1-22 |
| Enter a Number, Letter or Command | 1-7 | Gas Analyzer Use and Care | 1-23 |
| Cursor | 1-7 | General Test Procedure | 1-24 |
| [F10] "Previous Menu Key" | 1-7 | Task Switching | 1-24 |
| Major Components | 1-8 | Expansion Options Menu | 1-24 |
| Test Leads and Accessories | 1-9 | Help | 1-24 |
| Optional Ignition Adapters | 1-10 | Step 1: Turn the Analyzer on | 1-25 |
| Optional Accessories | 1-10 | Step 2: Enter Customer Information | 1-25 |
| Specifications and Ranges | 1-10 | Select an Existing Customer | 1-25 |
| Dimensions | 1-10 | Specification Message | 1-26 |
| Host Software | 1-10 | Enter a New Customer | 1-26 |
| Exhaust Analyzer | 1-10 | Deleting A Customer Entry | 1-26 |
| Memory Requirements | 1-10 | Replace a Customer with a | |
| Engine Analyzer Measurements | 1-11 | New Entry in the Customer List .. | 1-26 |
| Remote Control Unit | 1-12 | Step 3: Enter Vehicle Specifications | 1-27 |
| Key Functions | 1-12 | Loading Vehicle Specifications by | |
| Keyboard | 1-13 | Year/Make/Model | 1-27 |
| Computer Controls | 1-14 | Editing Specifications | 1-29 |
| Printer Controls | 1-15 | Linking Vehicle Specs | |
| Setting Top of Form (TOF) | 1-15 | to Customer Information | 1-29 |
| Front Panel Controls | 1-15 | Quick Spec Entry | 1-30 |
| Print Mode | 1-15 | Step 4: Select a Test | 1-31 |
| Lights | 1-15 | Direct Access | 1-31 |
| Control Buttons | 1-16 | Step 5: Connect the Test Leads | 1-32 |
| Menu Select Mode | 1-17 | Secondary Ignition Adapters | 1-33 |
| Enter the "Menu Select Mode" | | Attaching the Adapter Probe | 1-34 |
| from the "Print Mode" | 1-17 | Removing the Adapter Probe | 1-34 |
| Enter the Menu Select Mode | | DIS Leads | 1-35 |
| from the "Power Off" State | 1-17 | DIS Secondary Probe Assemblies | 1-35 |
| Control Button Functions in | | Special DIS Secondary Clip | |
| Menu Select Mode | 1-17 | Connections | 1-36 |
| Menu Screen Components | 1-18 | Check the Trigger Lead Status | 1-37 |
| Meter and "Live" Screen Components | 1-19 | Step 6: Run the Test and Access Diagnostic | |
| | | Messages | 1-37 |
| | | Step 7: Print Test Reports | 1-38 |

continued ...

Chapter 2: Diagnostic Tools

| | |
|---|------|
| Hot Keys | 2-1 |
| Quick Comprehensive Test | 2-3 |
| Prepare For Testing | 2-4 |
| Visual Inspection | 2-4 |
| Battery | 2-5 |
| Belts | 2-5 |
| Fluid Levels | 2-5 |
| Filters, Emission Control Devices | 2-5 |
| Electrical Connections | 2-5 |
| Exhaust System | 2-5 |
| Hoses | 2-5 |
| Radiator and Cap | 2-5 |
| Test Procedure | 2-6 |
| Reviewing Previous Test Results | 2-7 |
| Symptom Analysis | 2-7 |
| Procedure | 2-7 |
| Diagnostic Test Menu | 2-10 |
| Battery Diagnostic | 2-10 |
| Overview | 2-10 |
| Minimum Leads Required | 2-10 |
| Recommended Lead Hookup | 2-10 |
| Test Procedure | 2-10 |
| Cranking Test Diagnostic | 2-11 |
| Conventional Ignitions | 2-11 |
| Required Lead Hookup | 2-11 |
| Recommended Lead Hookup | 2-11 |
| Required Lead Hookup | 2-12 |
| Ported Fuel Injection (PFI) with Clear Flood Mode, and Sequential Fuel Injection (SEFI) with Clear Flood Mode | 2-12 |
| Ported Fuel Injection (PFI) without Clear Flood Mode, and Sequential Fuel Injection (SEFI) without Clear Flood Mode | 2-13 |
| Throttle Body Injection (TBI) and | 2-13 |
| Central Fuel Injection (CFI) | 2-13 |
| Disabling Carbureted Fuel Systems | 2-13 |
| Carburetor with Electric Fuel Pump | 2-13 |
| Carburetor with Mechanical Fuel Pump | 2-13 |
| Carburetor with Decel Valve | 2-13 |

| | |
|--|------|
| Charging Test Diagnostic | 2-14 |
| Overview | 2-14 |
| Conventional Ignitions | 2-14 |
| Required Lead Hookup | 2-14 |
| Recommended Lead Hookup | 2-14 |
| Direct Ignition Systems (DIS) | 2-14 |
| Required Lead Hookup | 2-14 |
| Test Procedure | 2-14 |
| Results Screen | 2-15 |
| Charging Live Screen | 2-16 |
| Cylinder Efficiency/Performance | 2-16 |
| Cylinder Efficiency (Conventional Ignitions) | 2-16 |
| Required Lead Hookup | 2-16 |
| Recommended Lead Hookup | 2-16 |
| Cylinder Contribution | 2-17 |
| Power Check | 2-17 |
| Required Lead Hookup | 2-17 |
| Recommended Lead Hookup | 2-17 |
| Automatic Testing | 2-18 |
| Manual Testing | 2-18 |
| Cylinder Performance (DIS Vehicles) | 2-18 |
| Required Lead Hookup | 2-18 |
| Recommended Lead Hookup | 2-18 |
| Fuel System Diagnostic | 2-20 |
| Conventional Ignitions | 2-20 |
| Required Analyzer Hookup | 2-20 |
| Recommended Lead Hookup | 2-20 |
| Direct Ignition Systems | 2-20 |
| Required Analyzer Hookup | 2-20 |
| Primary Ignition Diagnostic | 2-21 |
| Required Lead Hookup | 2-21 |
| Recommended Lead Hookup | 2-21 |
| Test Result Definitions | 2-22 |
| Dwell Test Result Definitions | 2-22 |
| Secondary Ignition Diagnostic | 2-23 |
| Conventional Ignition | 2-23 |
| Secondary Live Screen | 2-24 |
| Digital Secondary KV - DIS | 2-24 |
| DIS Secondary Live Screen | 2-25 |
| Timing Test Diagnostic | 2-25 |
| Timing Live Screen | 2-27 |
| User Tests | 2-27 |

Chapter 3: Service Tools

| | | | |
|--|-----|-------------------------------------|------|
| Hot Keys | 3-1 | Drain Test | 3-9 |
| Battery / Charging / Starting Menu | 3-3 | Required Leads | 3-9 |
| Battery Test | 3-3 | Test Procedure | 3-9 |
| Overview | 3-3 | Fuel System Menu | 3-10 |
| Required Lead Hookup | 3-3 | Menu Choices | 3-10 |
| Recommended Lead Hookup | 3-3 | Four Gas Exhaust Test | 3-11 |
| Test Procedure | 3-3 | Conventional Ignitions | 3-11 |
| Charging Test | 3-4 | Required Lead Hookup | 3-11 |
| Overview | 3-4 | Recommended Lead Hookup | 3-11 |
| Conventional Ignitions | 3-4 | Direct Ignition Systems | 3-11 |
| Required Lead Hookup | 3-4 | Required Lead Hookup | 3-11 |
| Recommended Lead Hookup | 3-4 | Live Screen | 3-11 |
| Direct Ignition Systems (DIS) | 3-4 | Diagnostic Procedure | 3-11 |
| Required Lead Hookup | 3-4 | Fuel Injection Test | 3-12 |
| Charging Live Screen | 3-4 | Required Lead Hookup | 3-12 |
| Diagnostic Test Procedure | 3-5 | Recommended Lead Hookup | 3-12 |
| Charging Results Screen | 3-6 | Test Procedure | 3-12 |
| Cranking Test | 3-7 | Moving flags | 3-14 |
| Conventional Ignitions | 3-7 | Ignition Test Menu | 3-15 |
| Required Lead Hookup | 3-7 | Primary Ignition Test | 3-15 |
| Recommended Lead Hookup | 3-7 | Required Lead Hookup | 3-15 |
| Cranking Live Screen | 3-7 | Recommended Lead Hookup | 3-15 |
| Diagnostic Procedure | 3-7 | Diagnostic Procedure | 3-15 |
| Direct Ignition Systems (DIS) | 3-8 | Test Result Definitions | 3-16 |
| Required Lead Hookup | 3-8 | Dwell Test Result Definitions | 3-17 |
| PFI (Ported Fuel Injection) Vehicles | 3-8 | Secondary Ignition Test | 3-17 |
| For GM TBI (Throttle Body Injection) | | Required Lead Hookup | 3-17 |
| Vehicles | 3-8 | Recommended Lead Hookup | 3-17 |
| For Ford, Chrysler / Mitsubishi, | | Secondary Live Screen | 3-17 |
| and Other Systems | 3-8 | Diagnostic Procedure | 3-18 |
| Ported Fuel Injection (PFI) with Clear Flood | | Conventional Ignition | 3-18 |
| Mode, and Sequential Fuel Injection | | KV Readings | 3-18 |
| (SEFI) with Clear Flood Mode | 3-8 | Digital Secondary KV - DIS | 3-19 |
| Ported Fuel Injection (PFI) without Clear | | Required Lead Hookup | 3-19 |
| Flood Mode, and Sequential Fuel Injection | | DIS Secondary Live Screen | 3-19 |
| (SEFI) without Clear Flood Mode | 3-9 | Diagnostic Procedure | 3-19 |
| Throttle Body Injection (TBI) and | | Ignition Pattern Scope | 3-20 |
| Central Fuel Injection (CFI) | 3-9 | Parade Pattern | 3-20 |
| Disabling Fuel Systems - Carburetor | 3-9 | Required Analyzer Hookup | 3-20 |
| Carburetor with Electric Fuel Pump | 3-9 | Recommended Analyzer Hookup | 3-20 |
| Carburetor with Mechanical Fuel Pump | 3-9 | DIS Vehicles | 3-21 |
| Carburetor with Decel Valve | 3-9 | Required Analyzer Hookup | 3-21 |
| | | Recommended Analyzer Hookup | 3-21 |
| | | Raster Patterns | 3-21 |

continued ...

| | |
|--|------|
| Sequential Pattern | 3-22 |
| Timing Test | 3-23 |
| Timing Live Screen | 3-23 |
| Required Lead Hookup | 3-23 |
| Recommended Lead Hookup | 3-23 |
| Diagnostic Procedure | 3-23 |
| Cylinder Miss Recall | 3-25 |
| Required Lead Hookup | 3-25 |
| Recommended Lead Hookup | 3-25 |
| Cylinder Power Menu | 3-26 |
| Cylinder Speed Variation Test | 3-26 |
| Required Lead Hookup | 3-26 |
| Recommended Lead Hookup | 3-26 |
| Interpreting the Curve | 3-27 |
| Cylinder Contribution Test | 3-28 |
| Required Lead Hookup | 3-28 |
| Recommended Lead Hookup | 3-28 |
| Cylinder Efficiency (Conventional Ignitions) | 3-28 |
| Cylinder Power Check | 3-29 |
| Required Lead Hookup | 3-29 |
| Recommended Lead Hookup | 3-29 |
| Automatic Testing | 3-30 |
| Manual Testing | 3-30 |
| Cylinder Performance (DIS Vehicles) | 3-30 |
| Required Lead Hookup | 3-30 |
| Recommended Lead Hookup | 3-30 |
| Multi-Analyzer Menu | 3-31 |
| Multi-Adjustments | 3-31 |
| Multi-Meter | 3-32 |
| Changing the Multi-Meter Setup | 3-32 |
| Multi-Meter Ranges | 3-32 |
| Multi-Scope | 3-33 |
| Synchronizing the Pattern | 3-34 |
| Expanded Dual-Trace Scope | 3-35 |
| Printing Reports | 3-36 |
| Moving Flags | 3-36 |
| Uniscope | 3-36 |
| Synchronizing the Pattern | 3-36 |
| Printing Reports | 3-38 |
| Moving Flags | 3-38 |

Chapter 4: Expansion Options

| | |
|--|-----|
| Hot Keys | 4-2 |
| Task Switching | 4-2 |
| On-Board Computer (OBC) | 4-3 |
| About the OBC Function | 4-3 |
| Software Updates | 4-3 |
| Flow Charts | 4-4 |
| Flow Chart Module Automatic Activation | 4-4 |
| Other Options Menu | 4-5 |
| Running an Optional Application | 4-5 |
| Return to the Analyzer Software | 4-6 |
| Adding New Options | 4-6 |
| If No Options Are Currently Installed | 4-6 |
| If other options are installed | 4-6 |
| Editing an Optional | 4-7 |
| Application Name or Path | 4-7 |
| Deleting an Optional Application | 4-8 |
| Exit to DOS | 4-8 |

Chapter 5: Utilities

| | |
|--|------|
| Hot Keys | 5-1 |
| Dealer Information | 5-3 |
| Calibrate | 5-3 |
| Calibrating Leads | 5-3 |
| Calibrate Gas Bench | 5-4 |
| Successful Gas Calibration | 5-5 |
| Failed Gas Calibration | 5-5 |
| Enter Gas Calibration Values | 5-6 |
| Gas Calibration Verification | 5-6 |
| Diskette Utilities | 5-7 |
| Formatting Diskettes | 5-7 |
| Self-Diagnostic Tests | 5-8 |
| Module Tests | 5-8 |
| Update Module Status Information | 5-8 |
| Computer System Tests | 5-9 |
| Setup System | 5-9 |
| Set Time and Date | 5-9 |
| Printer Setup | 5-10 |
| Set Country Format | 5-11 |
| Time | 5-12 |
| Set Units | 5-12 |
| Engine Analyzer Configuration | 5-13 |
| Set Diagnostic Limits | 5-14 |

| | |
|---|------|
| Edit User Tests | 5-15 |
| Deleting a Group Test | 5-16 |
| Editing a Group Test | 5-16 |
| Adding an Item to a Group Test | 5-16 |
| Deleting an Item in a Group Test | 5-17 |
| Creating a New Group Test | 5-17 |
| Save Test Data to Disk | 5-18 |
| Saving Test Data to Hard Disk Drive | 5-18 |
| Saving Test Data to a Floppy Disk | 5-18 |
| Retrieve Test Data From Disk | 5-19 |
| Specification Message | 5-20 |
| Software Security | 5-21 |

Chapter 6: Maintenance

| | |
|---|------|
| Troubleshooting | 6-3 |
| Preventive Maintenance Schedule | 6-3 |
| Weekly Maintenance | 6-3 |
| Monthly Maintenance | 6-3 |
| Annual Maintenance | 6-3 |
| Software Problems | 6-3 |
| How to Obtain Service | 6-3 |
| Gas Bottle Service | 6-4 |
| Filters | 6-5 |
| Exhaust Sample Filters | 6-5 |
| Tri-Filter Assembly | 6-5 |
| Gas Bench Components | 6-5 |
| Tri-Filter Assembly Components | 6-6 |
| Exhaust Sample Filter Replacement | 6-6 |
| Water-Trap Filter Assembly | 6-7 |
| Cleaning the Primary Filter | 6-8 |
| Replacing the Secondary Filter | 6-8 |
| Cleaning the Aspirator | 6-8 |
| Cooling Fan Filter | 6-9 |
| Fuse Replacement | 6-9 |
| 120-Volt Operation | 6-9 |
| 230-Volt Operation | 6-9 |
| Printer Ribbon Removal (Okidata) | 6-9 |
| Printer Ribbon Replacement | 6-10 |
| Vacuum / Pressure Transducer O-Ring | 6-11 |
| General Cleaning | 6-11 |
| Video Display | 6-11 |
| Analyzer Surfaces | 6-11 |
| Replacement Parts | 6-12 |
| To Order Parts or Service | 6-13 |

Chapter 1

Introduction

The 400 Series Professional Work Station is a PC-based testing system that incorporates specially designed "smart modules" and custom software to aid in the service and repair of motor vehicles.

The 400 Series software is very intelligent. It automatically checks a customer test record for option information, including the Flow Charts and On-Board Computer options, and enables these modules in preparation for testing the vehicle.

Accurate performance and time-saving features make the 400 Series Professional Work Station a leader in its class.

Safety Precautions

Personal Safety

Read all service procedures and precautions, installation instructions and equipment operating manuals thoroughly. Failure to observe these precautions, or the improper use of equipment, could result in property damage, serious injury or death. Never allow improperly trained personnel to perform these procedures or operate equipment.

- To prevent electrical shock, avoid wet floors when plugging the analyzer into an electrical outlet.
- DO NOT install fuses of a higher ampere rating than specified.
- Read the operating instructions before attempting to operate the analyzer. Keep this manual with the analyzer at all times.

Ventilation

Provide ventilation through an exhaust gas removal system, ventilation fans or large doors. Inhalation of carbon monoxide gas, which is odorless and colorless, can cause serious illness, injury or death.

Fuel Systems

- Wear Safety Goggles!
- Keep lighted cigarettes, sparks, flames or other ignition sources away from fuel systems at all times.
- Minimize skin contact with any vehicle fuel. Do not swallow fuel.
- Make sure there is an ABC-type fire extinguisher nearby at all times. Know how to operate and maintain ABC-type fire extinguishers.
- NEVER pour gasoline down the carburetor to start the engine.
- To reduce the risk of fire and personal injury, release fuel system pressure before servicing any fuel system components.
- When testing fuel injection systems, wrap any fuel rail taps with a towel to control any leakage.
- When bleeding fuel injection systems, carefully pour the excess fuel into a container designed for gasoline storage and transportation.

Batteries

Automotive batteries contain sulfuric acid and produce explosive gases. To avoid battery explosion and serious injury or death, follow these important safety precautions whenever servicing batteries or performing tune-up procedures:

- Wear Safety Goggles!
- Keep lighted cigarettes, sparks, flames or other ignition sources away from battery at all times.
- DO NOT lay tools or equipment on battery. Accidentally grounding the "hot" battery terminal can cause shock, burns, and damage to wiring, battery, tools or tester.
- DO NOT wear jewelry, rings, watches or metal belt buckles when working on or around batteries.
- Cover battery vents with damp cloth to suppress explosive gases before load testing or charging.
- NEVER lean over battery during testing or charging.
- When connecting battery test leads, avoid sparks which could cause the battery to explode.
- Avoid spilling or splashing electrolyte on skin, eyes or clothing. Electrolyte contains sulfuric acid, is poisonous and causes severe burns.
- Be sure work area is well ventilated and has access to water should flushing be required.

Personal Safety

Protect Face, Hands and Feet From Burns and Other Injury:

- NEVER smoke or light a match when working on a vehicle. Gasoline vapor and battery gases are highly flammable and explosive.
- Make sure all electrical connections are tight. An improperly grounded condenser can cause engine backfire. NEVER look directly into the carburetor throat while the engine is cranking or running, since backfire can cause severe burns and injury.
- NEVER remove radiator pressure cap when system is under pressure or before the engine has cooled. Steam or hot coolant can cause burns if cap is removed before pressure is allowed to escape or while engine is hot.
- Avoid contact with hot surfaces such as spark plugs, exhaust manifolds and pipes, mufflers, catalytic converter, resonator, radiator and hoses, etc.
- When engine is running, DO NOT touch spark plug ignition cable wires, ignition coil or distributor cap.
- Turn off ignition key before installing, working on or adjusting contact sets, condensers, or other ignition parts.
- Use safety lights carefully. Route the cord safely outside or above engine compartment.
- Use proper tools and extensions carefully to avoid cuts and bruises on sharp engine parts when installing spark plugs into hard-to-get-at cylinders.

- Wear safety goggles to protect eyes from gasoline, dust and dirt flying off moving engine parts.
 - When working under the hood, make sure fan blades, belts, pulleys, etc. are in good condition. Any fan blade can break, especially when it has been bent.
 - Keep out of a direct line with fan blades, especially when testing timing advance with a timing light.
 - Keep hands, hair and clothes clear from any moving parts, including throttle and transmission linkages.
 - NEVER wear neckties, loose clothing, wrist watches, rings or other jewelry when working on a vehicle. They could catch on moving parts or cause an electrical short circuit resulting in severe electrical shock and burns.
 - Remove tools from vehicle before starting engine. Tools can fall into moving components and be propelled into the air, which could result in property damage or injury.
 - Avoid bringing hook-up leads over engine fan, pump and belt areas. Whenever possible, route leads outside of the engine compartment.
 - Electric fans are activated by a coolant temperature sensing switch. Disconnect a fan lead whenever working on a hot engine with an electric fan because the fan can start when the engine is "OFF."
 - Exercise caution when working in the engine compartment while the ignition key is turned ON; electrical shock and/or engine start hazards are present.
 - Avoid entanglement with fan blades, belts and pulleys when working around moving engine parts. Do not wear ties, loose clothing or dangling jewelry. When conducting engine running tests ventilate the area by using the building exhaust gas removal system, or by opening garage doors.
- Make Sure the Vehicle Cannot Move During Testing and Tune-Up!***
- Before testing vehicles, place the automatic transmission shift lever in the PARK position, or place manual transmission in NEUTRAL.
 - Securely set the parking or emergency brake on test vehicles. If there is any possibility the vehicle will roll, block the wheels.
 - Some vehicles have an automatic release on the parking brake when the vehicle is put in gear. Disconnect and plug automatic release vacuum hose before performing any tests while vehicle is in DRIVE. If there is any possibility that the vehicle might move, block the wheels.
 - Make sure motor mounts are in good condition. Broken motor mounts can cause an engine to jump into gear, or the throttle to stick when the engine is accelerated.
 - Take the vehicle out of gear after setting the carburetor. DO NOT rev the engine when the transmission is in "DRIVE."



Be sure to reconnect the fan lead before starting the vehicle to avoid overheating and damaging the engine!

About the Manual...

Figure 1-1 details page features that allow the reader to quickly find and easily understand information.

1 Chapter Heading - Allows the reader to locate main section headings while "thumbing through" the manual.

2 Topic Headings - Identifies major topics within the chapter.

3 Topic Sub-Headings - Calls attention to important concepts.

4 Illustrations - Explain important ideas or procedures.

5 Important Reader Messages:



When this symbol appears, the potential exists for serious injury and/or damage to the analyzer. **READ AND FOLLOW THE INSTRUCTIONS IN THIS TYPE OF NOTE CAREFULLY!**



Information in this type of note is extremely important and may affect analyzer operation and test result quality. **READ THESE NOTES CAREFULLY!**



Notes contain helpful hints and tips to make operating the analyzer easier.

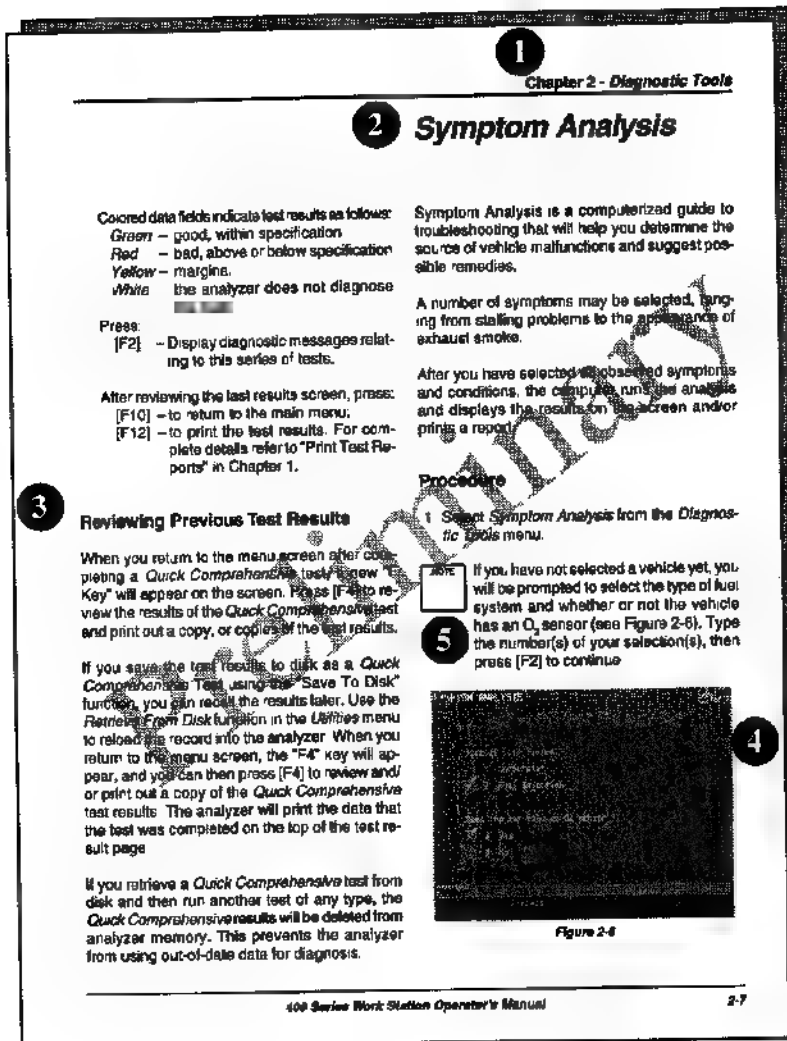


Figure 1-1

Conventions and Definitions

This manual uses the following written conventions, procedures and definitions:

Enter a Number, Letter or Command

Text that instructs the user to enter a number, letter or command, appears in brackets.

Example: "Select [1] from the Main Menu and press [ENTER]." This instruction is to press the number "1" key on the keyboard followed by the "Enter" key on the keyboard.

Cursor

The cursor is the point of action on the display screen. It is represented by a lighted dot or a reverse video bar that is moved around on the display screen by using the Arrow or Tab Keys on the keyboard.

[F10] "Previous Menu Key"

The [F10] "Previous Menu Key" returns the user to the menu screen that came directly before the current screen shown on the display.

Major Components

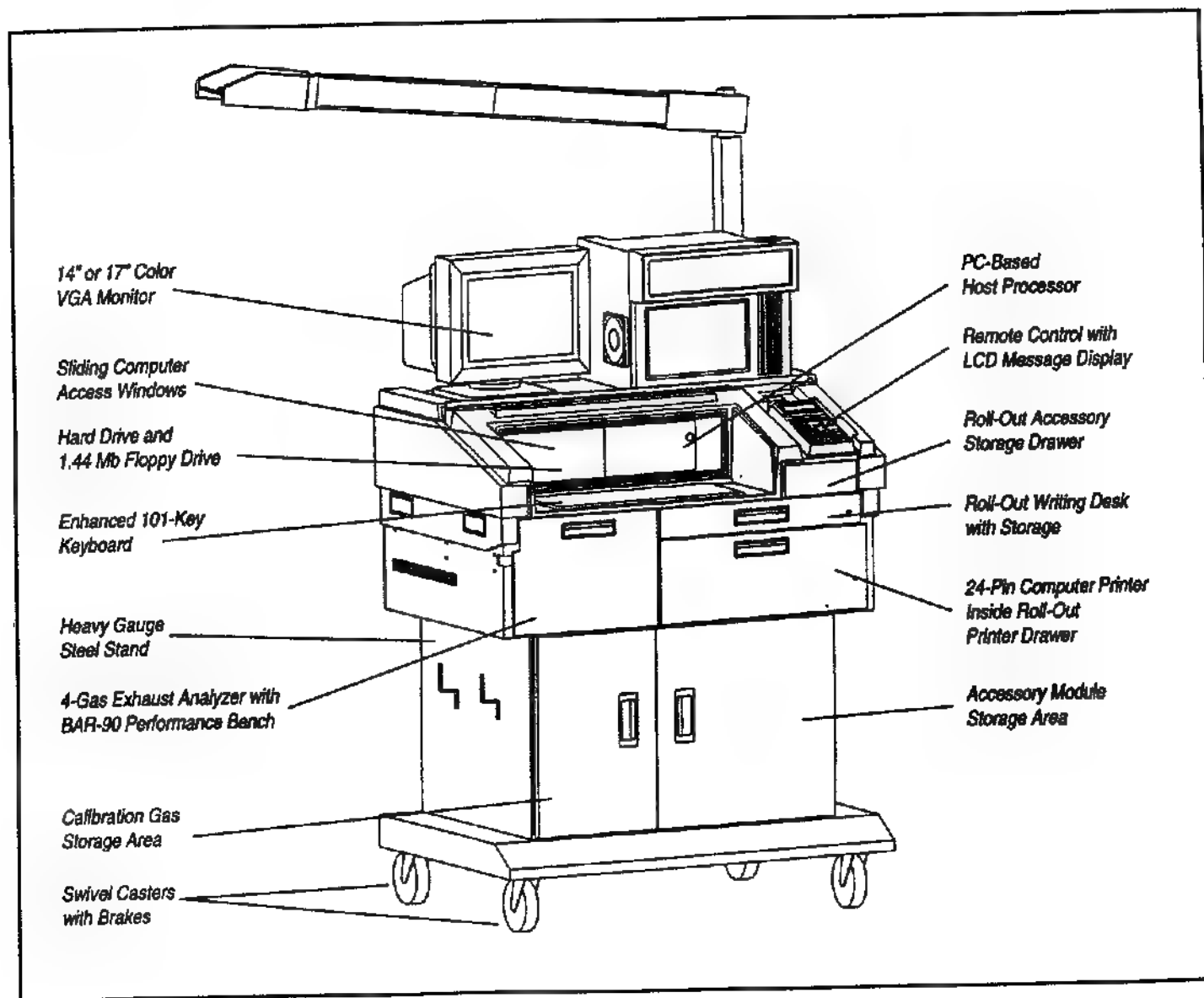


Figure 1-2

Test Leads and Accessories

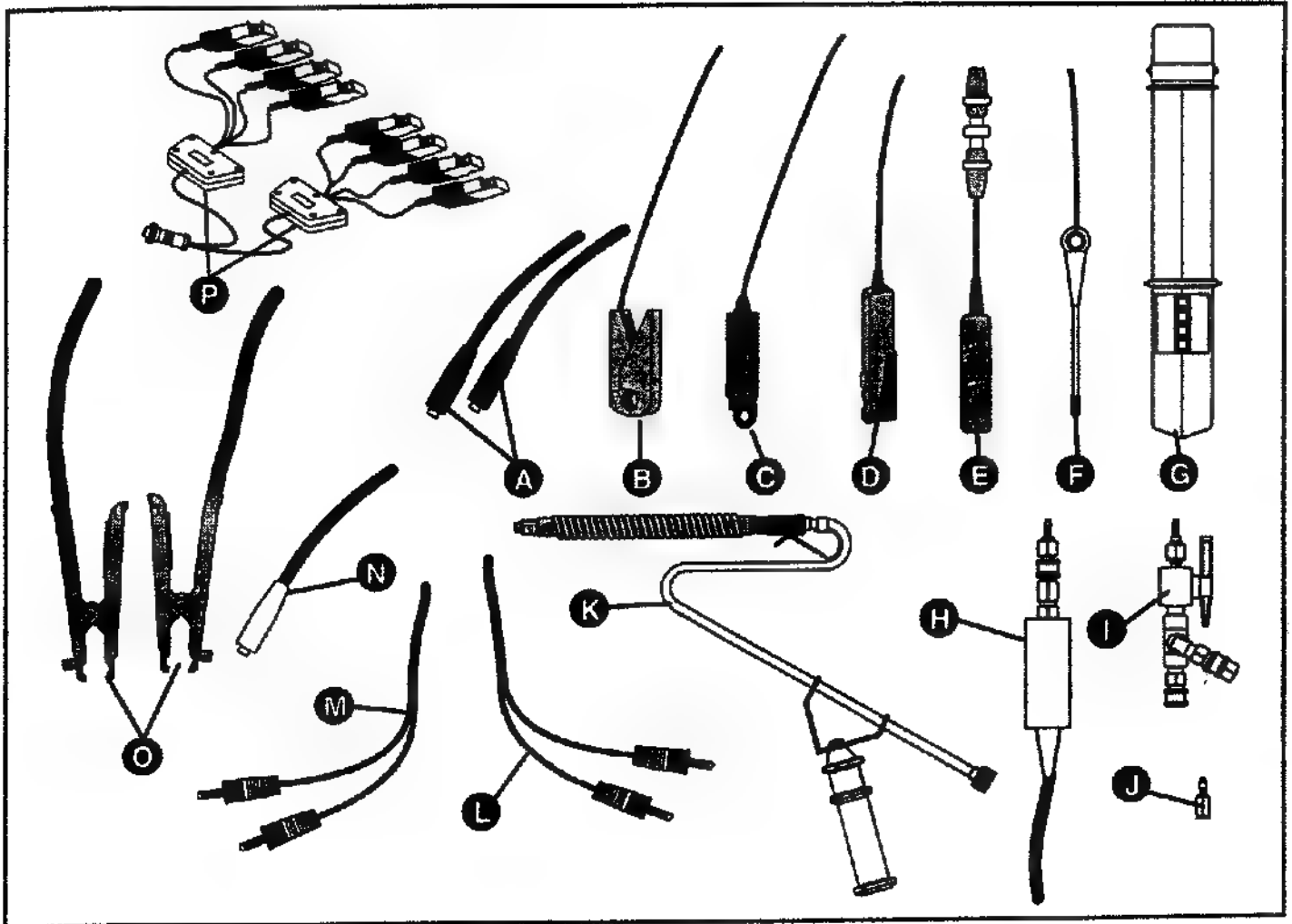


Figure 1-3

- | | |
|--|--|
| A - Coil Pos. (Yellow) and Coil Neg. (Blue) Leads | I - Vacuum/Pressure Transducer Bleed Adapter |
| B - Amp Probe | J - Fuel Rail Adapter—to connect bleed adapter and vacuum/pressure transducer to fuel rail |
| C - Low Current Probe | K - Exhaust Gas Analyzer Lead |
| D - Green #1 Lead | L - Multi-Meter Lead |
| E - Conventional Secondary Lead with Standard, HEI and Universal HT Adapters | M - Multi-Scope Lead |
| F - Temperature Lead | N - System Ground Lead |
| G - Timing Light | O - Battery Load Leads |
| H - Vacuum/Pressure Transducer | P - DIS Secondary Leads |

Optional Ignition Adapters

The 43-243 Adapter Kit includes the following standard primary ignition adapters for many domestic and import vehicles:

- Ford and GM electronic ignitions (including HEI)
- GM External Coil
- Ford E-Core, Thick Film Ignition (TFI) systems
- GM Micropak Coil
- Acura and Honda with Hitachi ignition system
- Toyota, Suzuki, Subaru, Isuzu, Mitsubishi and GM imports with Nippondenso ignition system
- Nissan with Hitachi ignition system
- AMC, Renault, Peugeot, and Jeep with Renix/Ducellier ignition system

Optional Accessories

- 43-285 CD ROM Kit
- Mitchell\Expertec CD software
- 43-289 Diagnostic Flowcharts
- 43-258 Phone Modem Kit

Contact an authorized representative for more details on adapter and accessory availability.

Specifications and Ranges

Dimensions

- | | | |
|------------------------|------------|------------|
| • Height: 61" | Width: 39" | Depth: 32" |
| • Net Weight: 575 lbs. | | |
| • Boom Height: 80" | | |
| • Boom Length: 54" | | |

Host Software

- MS DOS
- Host Program

Exhaust Analyzer

- Barometric Pressure Compensated
- Automatic Calibration
- 25 ft. Sample Hose
- Flexible Stainless Steel Probe
- Disposable sample filters
- Meets BAR-90 Accuracy
- Charcoal filter equipped for zero air
- Response Time: Less than 15 seconds to 95% final reading
- Warm-up Time: Less than 15 minutes to stable operation
- Meets or exceeds OIML CLASS I requirements (220V)
- Designed to meet or exceed AU II requirements (220V)

Memory Requirements

For optimum performance, your analyzer requires 590K of available conventional memory. Avoid installing any memory-resident or other programs that decrease the amount of available conventional memory below 590K.

Engine Analyzer Measurements

| Reading | Range | Resolution |
|------------------------------------|---------------------------------------|----------------------|
| Battery Voltage | 0 to 25 VDC | .01 VDC |
| High Current | -1000 to + 1000 DC Amps | 1.0 Amp |
| Low Current | -10 to +10 DC | Amps .01 Amp |
| RPM | 0 to 10,000 | 1 RPM |
| Cylinders | 1 to 12 Cylinders | |
| Secondary KV | -10 KV to + 40 KV - 2 KV to + 8 KV | 1 KV |
| Dwell | 0 - 360 Degrees | .1 Degree |
| Pressure | -15 to 85 PSI | 1 PSI |
| Vacuum | 0 to 30 In Hg | .5 In Hg |
| Multimeter Voltage ¹ | 0 to + 50 VDC 0 to 60 Volts AC RMS | .1 Volt DC .1 VAC |
| Multimeter Resistance ² | 0 to 2 megohms Measurement | .2 ohm |
| Multi-Trace Lab Scope | 0 to +/- 25.0 VDC | .02 VDC |
| Exhaust Analyzer | | |
| Hydrocarbons | 0 to 5000 PPM | 1 PPM |
| Carbon Monoxide | 0 to 10 % Vol | .01 % |
| Carbon Dioxide | 0 to 20 % Vol | .01 % |
| Oxygen | 0 to 20 % Vol | .01 % |

¹ Electrically Isolated. >10 Megohm Impedance

² Electrically Isolated

Figure 1-4

Remote Control Unit

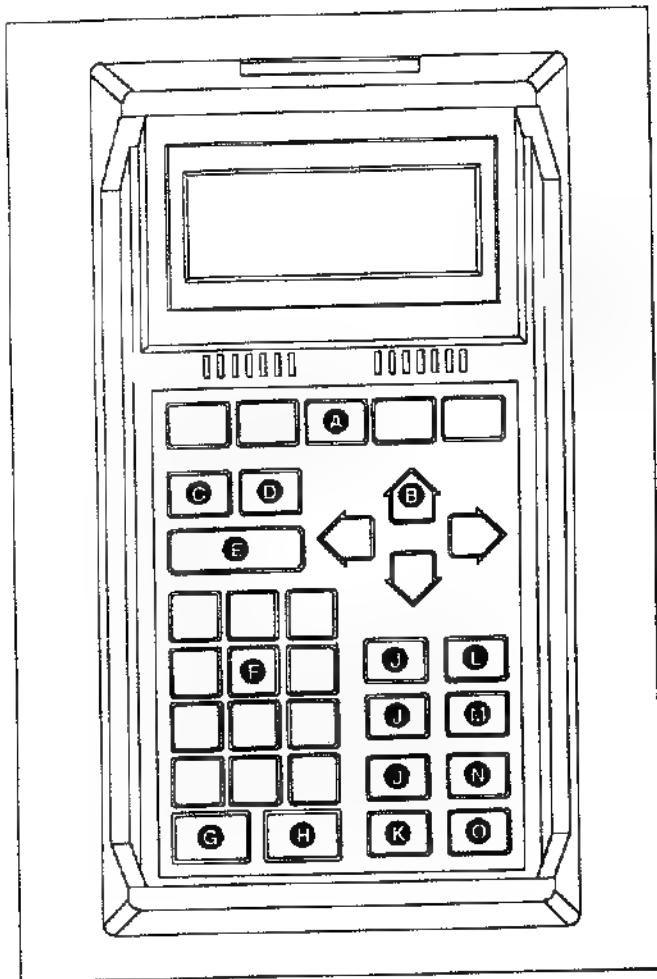


Figure 1-5

Use the remote to control the analyzer when you are seated in the car. All of the main keyboard functions are represented on the keypad.

The backlit LCD display is easy to read in low-light conditions. In addition, the remote is equipped with a speaker to beep when performing drain tests or continuity testing.

NOTE

Refer to "Engine Analyzer Configuration" in Chapter 5 for the proper procedure for adjusting contrast and brightness of the Remote Control Unit's display.

Key Functions

- A - Function Keys** — these keys match the F1 - F5 keys on the main keyboard. These keys perform a variety of functions during a test, and may change often.
- B - Arrow Keys** — these keys match the Arrow Keys on the main keyboard. Use the Arrow Keys to move the cursor, scroll up or down, etc.
- C - Prev Menu Key** — this key is the same as the [F10] key on the keyboard. Press this key to display the previous screen that came directly before the current screen shown on the display.
- D - Help** — this key accesses help information.
- E - Enter Key** — selects the option highlighted on the screen, or use as the enter key.
- F - Numeric and Icon Keys** — enter numbers and use the icon keys to enter decimal and signed (+/-) numbers.
- G - Alpha/Numeric** — use this key to toggle the Alpha-key configuration "ON" and "OFF." When the Alpha-key configuration is turned "ON," you can use the keypad to enter the letters of the alphabet.
- H - Clear Key** — press this key to clear the data in a highlighted field or to clear a graphic display and begin displaying new data.
- J - Memory Keys** — use these keys to store and manipulate memory functions.
- K - Status** — press this key to display the "Trigger Lead Status" screen.
- L - Paper Adv.** — this key matches the "F11" key on the main keyboard. Press this key to form feed the paper from the printer.
- M - Screen Dump** — print an exact copy of the display screen.
- N - Data print** — print the test reports. Matches the "F12" key on the main keyboard.
- O - Kill** — matches the "F8" key on the main keyboard.

Keyboard

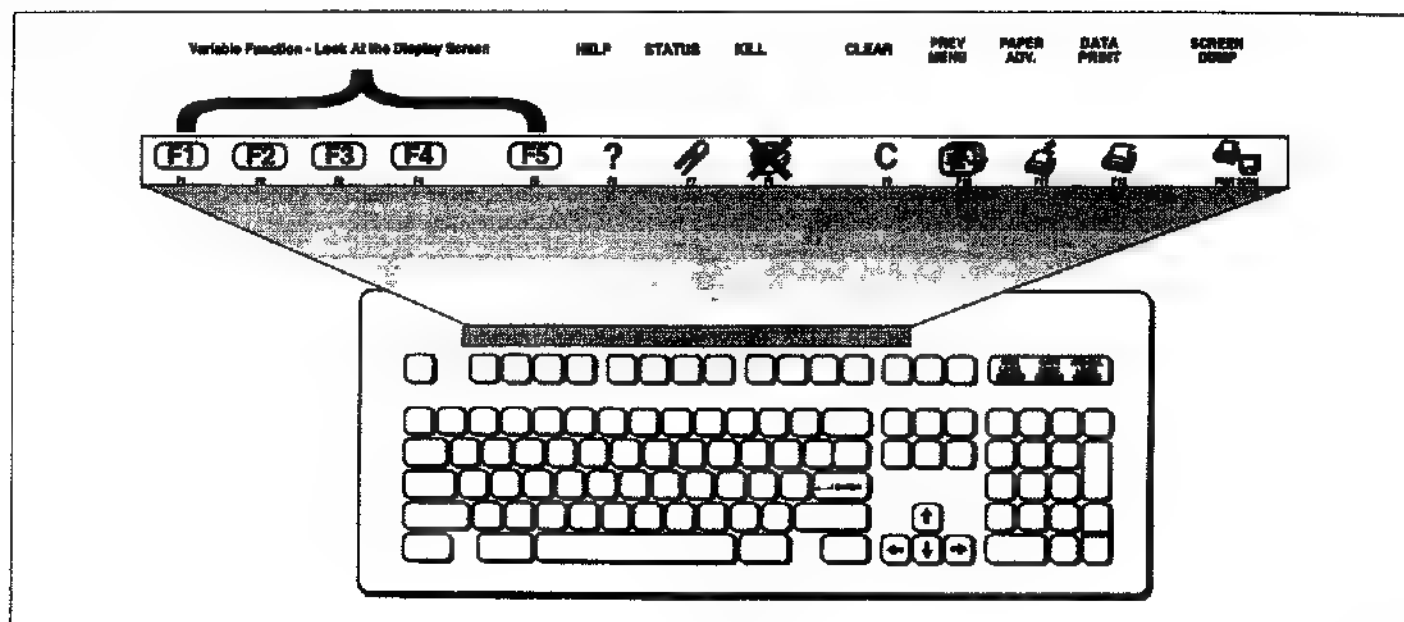


Figure 1-6

[F1]-[F5] – These keys vary according to each test routine. Each variable function is named in the function key buttons across the bottom of each screen.

[F6] (Help) – Press [F6] for a series of help messages that explain the inputs the analyzer is expecting, as well as the information the analyzer is displaying.

[F7] (Trigger Lead Status) – Displays the "Trigger Lead Status" screen.

[F8] (Kill) – Disables the ignition primary to stop the engine if the primary BLUE Lead is connected to the Negative side of the ignition coil and the White Engine Analyzer Ground Lead is connected to the Negative Battery terminal.

[F9] (Clear) – In any information screen, clears the data from the highlighted screen. From any test screen, clears the pattern display and begins displaying new data.

[F10] (Previous Menu) – Aborts the test in progress and returns to the previous menu.

[F11] (Form Feed) – Advances the paper in the report printer one full page.

[F12] (Print Reports) – Prints the data and diagnostic messages after any test has been run. From any menu screen, press [F12] to display the "Print Reports" menu.

[PrtSc] (Print Screen) – Prints a "screen dump" - an exact copy of what appears on the screen.

Computer Controls

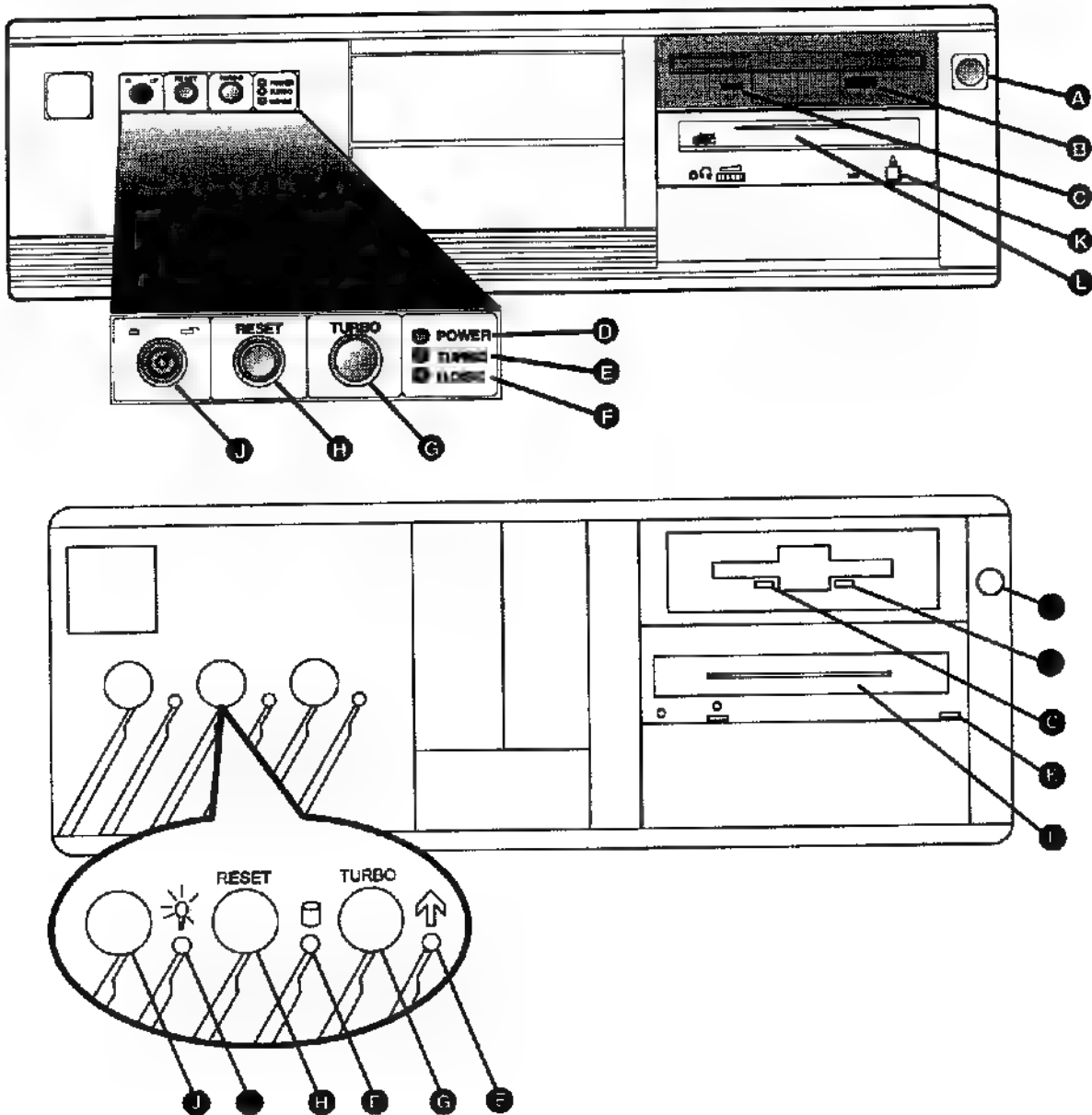


Figure 1-7

- A – Computer Power ON/OFF
- B – Floppy Disk Eject Button
- C – Floppy Disk Drive In Use Light
- D – Power On Light
- E – Turbo Mode On Light
- F – Hard Disk In Use Light
- G – Turbo Mode ON/OFF Button

- H – Reset Button — reboot the computer by pushing this button.
- J – Key Lock — Use the keys provided to lock the computer to prevent unauthorized people from tampering with the computer.
- K – CD-ROM Eject button
- L – CD-ROM Access Door

Printer Controls

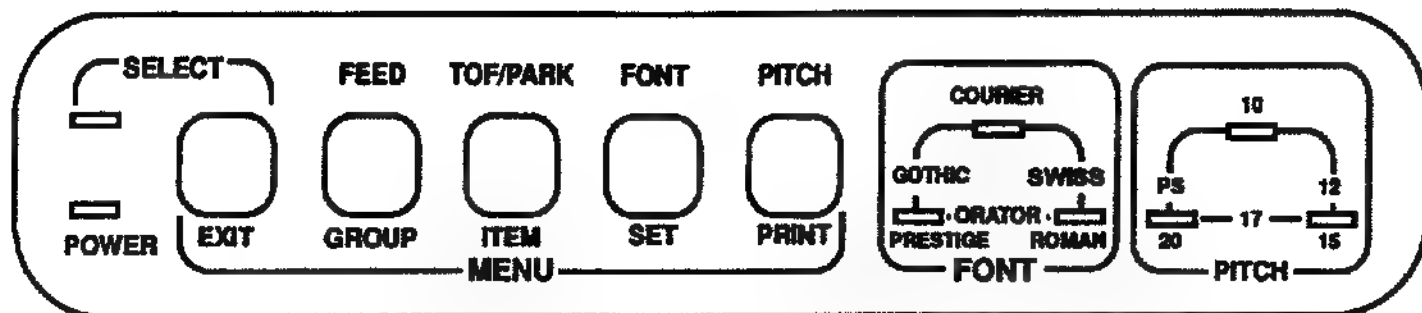


Figure 1-8

NOTE

These instructions apply to the Okidata Microline 380 printer.

Setting Top of Form (TOF)

1. Press "TOF/PARK" button.
2. The paper will retract.
3. Open the bail lever.
4. The paper will feed through and stop.
5. Close the bail lever. The paper will retract, and TOF is now set.

Front Panel Controls

There are five buttons on the control panel (refer to Figure 1-8). The functions represented by the labels at the top of each button are engaged when the printer is in "Print Mode." The functions represented by the labels at the bottom of each button are engaged when the printer is in "Menu Select Mode." In "Menu Select Mode" the operator can change the printer's default settings.

Print Mode

When the printer is turned "ON" it defaults to "Print Mode," ready to receive data or commands from the analyzer.

Lights

Power Light – This light indicates that the printer is turned on.

Select Light – When this light is "ON," the printer is selected and ready to receive data from the computer. When the light is "OFF," the printer is deselected and can't receive data. When the light is flashing, the printer is out of paper or an error (such as a paper jam) has occurred.

Font Lights – These lights indicate which font is engaged. When all font lights are "OFF," the printer is in the "Utility Print Mode."

Pitch Lights – These lights indicate which pitch is engaged.

Control Buttons

Select Button – Push this button to select or deselect the printer (“SELECT” light is “ON” or “OFF”).

To reset the printer to factory default settings, hold down the “SELECT” button and the “FEED” button while turning on the printer. (See Appendix B in the printer manual for more information on the menu factory settings.)

Hold down the “SELECT” button and the “TOF/PARK” button while turning on the printer, to place the printer in the hex dump mode. Refer to the printer manual for more information.

Feed Button – Push and release this button to advance the paper one line. Push the button and hold it for approximately one second, to advance the paper to the first print line of the next page.

Hold down this button while turning on the printer, to engage the “Self Test Mode.” Refer to the printer manual for more information.

TOF/PARK Button – When the printer is selected, push this button to park continuous-form paper. The paper will retract from the front of the printer so the operator can use single sheets without completely removing the continuous forms. Refer to the printer manual for more information.

When the printer is deselected, push this button to set the position of the first print line on the page (“top of form”).

Hold down the “TOF/PARK” button while turning on the printer, to engage the Rolling ASCII test.

Font Button – Push this button (printer selected or deselected) to select the font to use. Refer to the printer manual for more information.

The “FONT” lights to the right of the “FONT” button indicate which font is engaged. If only one light is glowing, then the font associated with it is engaged (Courier, Roman, or Prestige). If two lights are glowing, then the font between them is engaged (Swiss, Orator, or Gothic).

NOTE When the printer is placed in the Utility print mode, all of the “FONT” lights stop glowing.

NOTE The printer is set to the Utility print mode when the system is set up. For best operation of the analyzer software, the printer should be left in this mode.

Push the “FONT” button while turning on the printer to enter the “Menu Select Mode.”

Pitch Button – Push this button (printer selected or deselected) to select the pitch (character width). Refer to the printer manual.

The “PITCH” lights to the right of the “PITCH” button indicate which pitch is engaged. If only one light is glowing, then the pitch associated with that light is engaged (10, 15, or 20 cpi). If two lights are glowing, then the pitch between them is engaged (12, 17, or PS).

Menu Select Mode

Use this mode to create custom defaults for the printer. When the printer is in the Menu Select Mode, the function of the control panel buttons corresponds to the label below them: "EXIT," "GROUP," "ITEM," "SET," and "PRINT."

For a listing of all the menu selections, refer to the printer manual.

NOTE The operator can override features set on the menu using either the front panel or commands sent from the computer. However, when the printer is turned "OFF," features set by those methods will be cancelled. Features set on the menu will stay in effect, even when the printer is unplugged.

Enter the "Menu Select Mode" either directly from the "Print Mode" or from the power off state.

Enter the "Menu Select Mode" from the "Print Mode:"

1. Make sure the printer has ribbon and paper.
2. Press the "FONT" and "PITCH" buttons simultaneously. The "SELECT" light will go off and "Menu Mode" will print. Make menu changes by using the control panel.
3. To return to the "Print Mode," press the "EXIT" button. The "SELECT" indicator will light.

Enter the Menu Select Mode from the "Power Off" State:

1. Make sure the printer has ribbon and paper, and that it is turned "OFF."

2. Hold down the "FONT" button while turning the printer "ON." The "POWER" light will come on ("SELECT" light remains "OFF") and "Menu Mode" will print. Make menu changes by using the control panel.

3. To switch to the "Print Mode," press the "EXIT" button. The "SELECT" indicator will light.

Control Button Functions In Menu Select Mode

Group Button – Push this button to move to the next Group in the menu.

Item Button – Push this button to move to the next Item within the Group.

Set Button – Push this button to move to the next setting within the Item. Once a setting is changed, it will be stored in the printer's permanent memory, even if the printer is turned "OFF," until the operator presses "SET" with that Group and Item selected.

Print Button – Press this button at any time while in "Menu Select Mode" to print a listing of all the current menu settings. Print out the menu whenever it is changed for reference.

Exit Button – Push this button to exit the "Menu Select Mode" and return the printer to the "Print Mode."

For detailed information on changing printer settings, refer to the printer manual.

Menu Screen Components

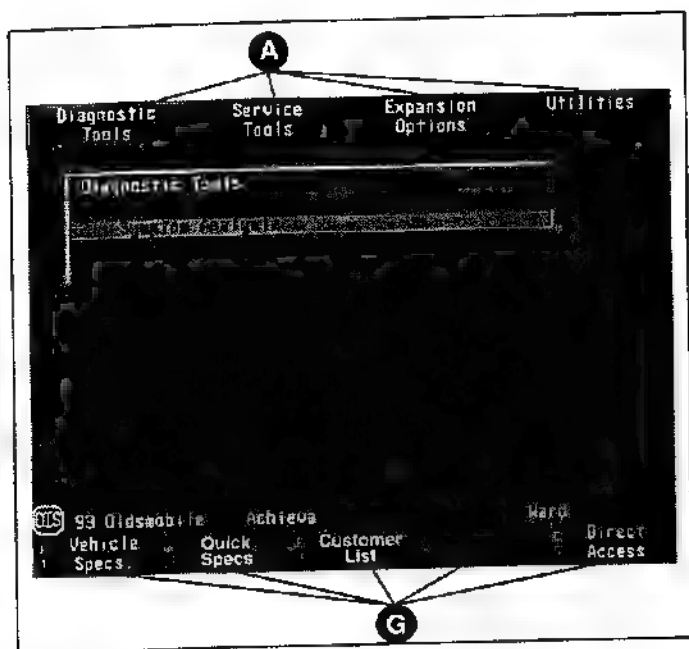


Figure 1-9

A - The Main Menu Bar – (see Figure 1-9) positioned across the top of the screen, contains four pop-down submenus:

Diagnostic Tools – These routines assist in troubleshooting and allow you to test various vehicle systems and use customized test sequences.

Service Tools – Provides a menu of pre-programmed diagnostic screens as well as “live” meter screens to allow you to get an overall view of system performance.

Expansion Options – Provides a menu for selection of powerful optional tools such as Flowcharts, On-Board Computer, etc. This menu also provides a function to allow the operator to add new options from other sources to the analyzer.

Utilities – Allows the operator to set up report headers, to calibrate the test leads, change time and date settings, and more.

B - Menus – Menus list the functions available to the operator. Some menu items point to sub-menus of secondary test routines.

C - Menu Highlight – Move this highlight either by using the Up or Down Arrow Keys or by typing in the menu item number. Press [ENTER] to start the test or access the submenu.

D - Customer Last Name – This appears on screen to indicate that customer information has been entered.

E - Specification – Indicates that specifications for the make, model and year have been entered into analyzer memory. This spec can be changed or edited.

F - DIS Icon – Indicates that the analyzer is configured for DIS testing.

G - Function Keys – Press the “F” key indicated to access the function listed in the box.



The “F” keys shown on the Main Menu pictured in Figure 1-9 appear when no customer is loaded. If a customer is loaded, the “F” keys will be as follows:

| | | |
|----|---|---------------|
| F1 | - | No Customer |
| F2 | - | Edit Customer |
| F3 | - | Customer List |
| F5 | - | Direct Access |

Meter and "Live" Screen Components

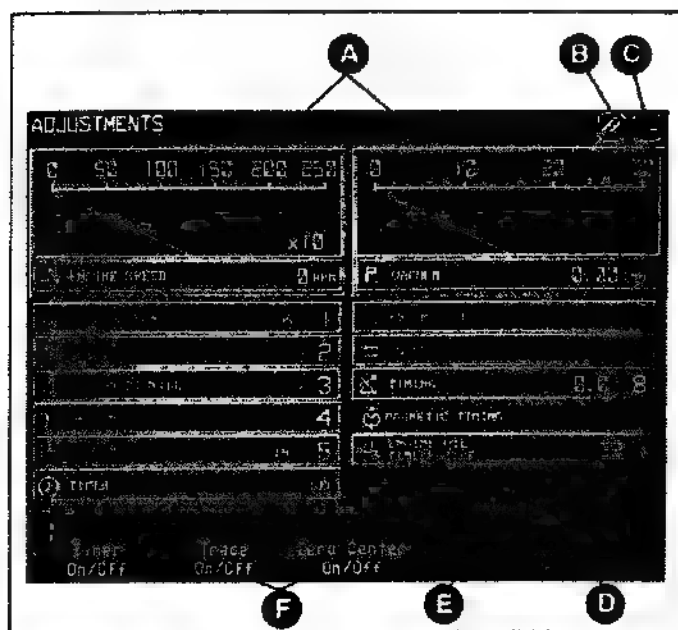


Figure 1-10

Figure 1-10 shows a typical meter and data screen. Most screens will have these common components:

- A - Analog Meters** – Meters are auto ranging (sliding scales) for maximum flexibility. Meters feature a trace function to show trends and also a zero-center function.
- B - Trigger Lead Status Icon** – If this icon flashes, press [F7] to display the "Trigger Lead Status" screen (refer to Figure 1-11). This screen indicates which leads are not functioning correctly.

C - Previous Menu Icon – Whenever this icon appears, press [F10] to return to the previous menu. If you are running a user test, press [F10] to start the next test in the series.

D - Digital Meters – These areas of the screen display all of the meters or optional functions that are available, and/or display the current data readings. Gray options are not available, either because the meter or function is currently in use, or because it does not apply to the particular system being tested. Meters which are labeled with a number can be displayed in the analog meter boxes. Type the number of the meter and it will be displayed in the active analog meter box.

E - Message Center – This box displays test instructions, prompts and informational messages to explain what the analyzer is doing while it is calculating test results, etc.

F - Function Keys – Each box lists the "F" key that will activate a particular function. Usually, pressing [F2] will continue the program along to the next step in a test or will exit the test and return to the Engine Analyzer Main Menu.

Arrows (refer to "Icon Index") – When arrow icons appear on the screen, press the Up, Down, Left or Right Arrow Key on the keyboard to expand or shrink the display scales. This function is available in ignition pattern screens.

Trigger Lead Screen Components

This screen allows you to verify that the analyzer is receiving proper signals from the analyzer leads. Press [F7] from any screen showing the "Lead Status Icon." If the icon is flashing, there is a problem with the trigger leads.

1. Connect the leads to the test vehicle.
2. Press [F7]. The "Leads Status" screen appears (see Figure 1-11).



Figure 1-11

Press:

- [F1] – to change the trigger;
- [F2] – to return to the previous screen;
- [F3] – (Kill On/Off - not available for DIS systems) to kill the engine, if the blue Coil Negative lead is connected to the negative coil terminal and the white System Ground lead is connected to the negative battery terminal;
- [F4] – to zero out amp probe;
- [F5] – to zero out vacuum sensor.

3. Start the test vehicle and look at the screen. Correct any problems that are indicated and press [F10] to return to the previous menu.

Changing Trigger

Press [F1]. A menu of trigger choices appears (see Figure 1-12). Use the Up or Down Arrow Keys to choose the trigger that you want to use.

For Conventional Systems:

Primary/Secondary Trigger - Primary or secondary trigger, whichever is available.

Primary Only - Uses the primary trigger only.

For DIS Vehicles:

Secondary Trigger - Normal - Uses the secondary trigger (default).

Secondary Trigger - Special - This trigger is adjusted to compensate for higher trigger voltages caused by open plugs or other problems. Use this trigger to obtain a steady signal only when other triggers will not work.

Primary Trigger - Uses the Low Current Amp Probe clamped around the primary "B+" feed wire of the ignition module.

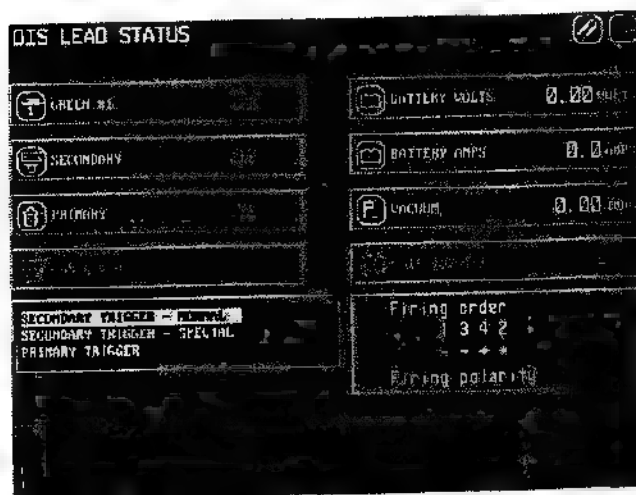













Figure 1-12

Icon Index






Main Icons

-  Trigger Lead Status (press [F7] to display)
-  DIS Specs Loaded (menu screens only)
-  Display Previous Menu (press [F10])
-  Arrow Keys (scroll up/down, change meter scales)








General Engine Data Icons

-  RPM
-  Timing
-  Vacuum
-  Dwell
-  Timing Light (Timing Light is Active)
-  Pressure
-  Magnetic / Stut


Battery System Icons

-  Rated CCA Units
-  Open Volts
-  Load Volts
-  Recovery Volts
-  Available CCA







Primary Ignition Icons

-  Battery Voltage
-  Positive Coil Volts
-  Negative Coil Volts
-  Average Dwell
-  Dwell Variation
-  Dwell On Variation
-  Dwell Off Variation









Secondary Ignition Icons

-  Cylinder Number
-  Average KV
-  Delta KV
-  Burn Time
-  Burn KV
-  Slope KV
-  Coil Oscillations
-  Snap KV
-  Circuit Gap

Gas Analysis Icons

-  Hydrocarbons
-  Carbon Dioxide
-  Carbon Monoxide
-  Oxygen
-  Corrected Carbon Monoxide
-  Lambda

Multimeter Screen Icons

-  Amps
-  Ohms
-  Zero Center Meter
-  AC Voltage
-  DC Voltage
-  Continuity
-  Timer
-  Pressure/Vacuum

Use and Care

Special Computer Precautions

A computer is a delicate piece of equipment. The following is a list of "Do's and Don'ts" for working with a computer:

- ALWAYS protect the power supply.
 - Make sure the analyzer is properly grounded.
 - Use a high-quality power filter/surge protector.
- ALWAYS protect the analyzer from water, dust, and direct sunlight whenever possible. DO NOT block the ventilation fans - computers can overheat quickly.
- NEVER move the analyzer when either disk drive is operating. In order to read and write huge amounts of data, the magnetic disk inside a drive must spin very rapidly. If the analyzer is moved suddenly or bumped while a disk is spinning, the drive and/or data may be damaged.
- NEVER place sources of magnetic or electrical interference near the computer. These sources include:
 - Magnets (many automotive parts generate a magnetic field)
 - Radios
 - Other electrical appliances
- NEVER place food or beverages on the analyzer. Carbonated sodas are excellent conductors of electricity and an accidental spill could easily short out critical components inside the computer.
- NEVER shut off power or unplug the analyzer while a disk drive is operating. Return to the main menu and wait until the disk drive has stopped operating before interrupting power.

1. The Engine Analyzer must be plugged into a 120V, 60HZ, properly grounded outlet. DO NOT cut off the grounding prong of the AC power cord. DO NOT use a ground adapter. If an extension cord is needed, use a 3-wire type with the grounding circuit in good condition.

NOTE

It is strongly recommended that a dedicated electrical outlet circuit be installed by an authorized electrical contractor, for use with the analyzer. This circuit should be connected to its own circuit breaker and should not share that circuit breaker with any other outlets in the building.

2. Do not operate the analyzer in direct sunlight for extended periods.
3. DO NOT expose the analyzer to rain or moisture, or operate it on a wet floor.
4. Follow the maintenance schedule listed in the Maintenance section of this manual.
5. Make sure that the battery power clamp connections are good. Check the clamps to make sure that they are clean and clean the battery terminals if necessary.
6. Do not drop the test leads.

Gas Analyzer Use and Care

To prevent damage to the sampling system, do not use the analyzer while a vehicle is running on a dynamometer. For further information, contact your sales representative.

1. Check the water trap and filter daily for excessive build-up of dirt or water.
2. Replace the sample system filter at least every other week.
3. Store the gas analyzer exhaust probe off the floor to prevent damage and contamination.
4. Remove exhaust probe from the tailpipe while carburetor or combustion chamber cleaners are being used in the engine. This is particularly important because of the highly corrosive nature of carburetor and combustion chamber cleaners.
5. Do not drop the exhaust probe; this will break the probe and cause leaks.
6. Do not disconnect the exhaust probe from the analyzer.
7. Do not test diesel exhaust; this will contaminate the sample system.

General Test Procedure

The following general procedure describes how you complete a test with the 400 Series Analyzer. Each step in the procedure is explained in more detail in the following sections.

1. Plug the analyzer in and turn it on.
 2. Enter the Customer Information.
 3. Enter the Vehicle Specifications:
 - From a Menu screen;
 - From the Customer Information screen.
 4. Select the test to be performed.
 5. Access the "Help" screens by pressing [F6] for information on leads needed to run tests, as well as recommended procedures, safety notes, definitions and other relevant information.
- NOTE
- Once vehicle specifications are loaded, Task Switching is enabled allowing the operator to access vehicle pictures. See "Task Switching" for more information.
6. Install leads on vehicle engine.
 7. Start the engine and allow the vehicle to warm up to normal operating temperature.
 8. Check the Lead Status Screen by pressing [F7] to make sure that the analyzer is receiving good signals from all test leads.
 9. Follow the prompts to complete the test.
 10. Print out the customer or technical reports required.

Task Switching

The 400 Series Professional Work Station provides Task Switching capability. Task Switching allows you to temporarily "leave" the WorkStation to retrieve data from another software module installed in the 400 unit. There are two methods of Task Switching available:

Expansion Options Menu

This method allows you access to all modules installed on the 400.

1. Exit the test you are performing and return to the Main Menu screen.
2. Select *Expansion Options*.



Most available modules will be accessible through the *Expansion Options* menu. But, some modules may have been installed via the *Other Options Menu*. If so, select *Other Options Menu* from the *Expansion Options* menu to access them.

3. From the list of available software modules, select the desired option.

Help

This method allows you to use FlowCharts software or Mitchell-On-Demand (if Mitchell-On-Demand and Vin-Pass are installed). It is accessible in most menus and tests.

1. Press [F6] Help.
2. Press [F3] Vehicle Information.
3. Select the desired Vehicle Information option.

When you leave FlowCharts and return to the 400, any test you were running resumes at the point it was suspended.

Step 1: Turn the Analyzer on

After turning the analyzer on, the title logo screen appears. Press any key to access the Main Menu screen.

Step 2: Enter Customer Information

Customer information can be retrieved from the Customer List. The customer list contains data for up to ten (10) customers at one time. The information is saved by the analyzer. This allows you to work on multiple jobs at the same time and recall the correct customer and specification information for each job.

NOTE If customer information has been entered, customer and vehicle data, along with diagnostic test data can be saved to diskette. See "Save Test Data to Disk" in Chapter 5 for the correct procedure.

To enter the "Customer List" screen, press [F3] from any menu screen, (see Figure 1-13).



Figure 1-13

Press:

- [F1] – to return to the Main Menu screen without making any changes. If customer information is held in analyzer memory, that information will be deleted, and the customer's last name will no longer appear at the bottom of the menu screen.
- [F2] – to enter a new customer. See "Enter a New Customer."

NOTE The "F2" key will appear only if there are nine (9) or less customers on the list.

- [F5] – to delete a highlighted customer entry from the list. See "Deleting a Customer."

Select an Existing Customer

1. Use the Arrow Keys to move the cursor to an existing customer in the customer list and press [ENTER].
2. The "Customer Information" screen appears (see Figure 1-14).

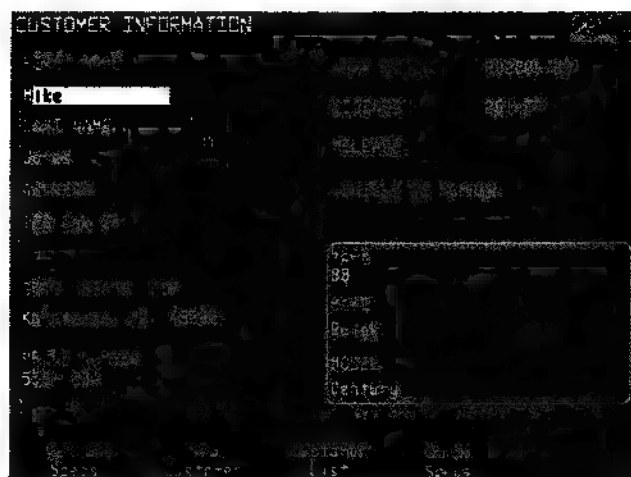


Figure 1-14

3. Use the Arrow or Tab Keys to move around the customer information screen. Update any data.
Press:

- [F1] – to enter vehicle specs (for details, see "Enter Vehicle Specifications" or "Linking Vehicle Specifications to Customer Information" below);
- [F2] – to enter a new customer;
- [F3] – to return to the "Customer List" to choose a different customer entry;
- [F4] – to use the "Quick Spec" entry method to enter the minimum vehicle specs necessary for testing. (see "Quick Spec Entry")

Specification Message

A specification message (see Figure 1-15) appears when a selected customer was last tested using a previous version of the 400 Series Analyzer Software. The system requests that the customer information and vehicle specifications be re-entered into memory.

The screenshot shows a terminal window titled "CUSTOMER INFORMATION". It has several input fields: FIRST NAME, LAST NAME, SPEC, ADDRESS, CITY, PHONE NUMBER, WORK ORDER, LICENSE, and HILEAGE. A large rectangular box is overlaid on the screen, containing the text "CUSTOMER INFORMATION" at the top and "TAURUS SHO 4 DR" at the bottom. At the bottom of the screen, there are three buttons: "Vehicle Specs", "New Customer", and "Customer List".

Figure 1-15

Press any key to clear the message and then press [F1]. The vehicle specification must be completed in order to allow the software to properly enable the expansion modules installed in the system.

Enter a New Customer

1. From the "Customer List" screen, press [F2] or move the cursor to a blank line in the customer list and press [ENTER]. The "Customer Information" screen appears. It is a similar screen to Figure 1-14, except with blank data fields.
2. Type in the information for each data field on the screen. When finished, press [F10] to save information in memory.

Deleting A Customer Entry

When the Customer List contains (10) ten names and a new customer needs to be added, determine an entry that can be deleted and follow the procedure below.

1. Use the Up or Down Arrow Keys to highlight the entry to be deleted.
2. Press [F5] to delete the customer from the list.
3. The analyzer prompts you to press [F5] a second time to confirm that you want to delete the highlighted customer.
4. Press [F10] to return to the previous menu screen.

Replace a Customer with a New Entry in the Customer List

1. Use the Arrow Keys to highlight a customer in the Customer List and press [ENTER].
2. The customer's information appears in the data fields. Press [F2], "New Customer."
3. The customer's information is erased. Input the new customer's information.
4. Press [F10] to save the new customer information in memory.

Step 3: Enter Vehicle Specifications

The analyzer contains a database of vehicle specifications. When you identify the manufacturer, make and model of the vehicle to be tested, the analyzer loads that information into memory and sets up appropriate tests to fit the vehicle.

Enter the Vehicle Specifications screen:

- from a Menu screen;
- from the Customer Information screen.

Load the vehicle specifications into analyzer memory:

- by Year/Make/Model;
- by creating a set of specifications manually.

Loading Vehicle Specifications by Year/Make/Model

1. From any Menu screen, press [F1] to enter a vehicle specifications selection screen (see Figure 1-16). Note that if a vehicle spec is already loaded in memory, or when an existing customer is selected, a full summary screen appears (see Figure 1-20). If the full summary screen appears, press [F3] "New Vehicle," to enter new vehicle specifications.



Figure 1-16

NOTE Press [F2] and a menu of available regional databases will be displayed (see Figure 1-17). Use the cursor keys to highlight the selection of your choice and press [ENTER]. You will be returned to the vehicle specification screen (see Figure 1-16).



Figure 1-17

2. Use the Up- or Down-Arrow Key to highlight the correct vehicle year and press [ENTER].
3. A list of vehicle manufacturers will now be displayed (see Figure 1-18). Use the Arrow Keys to move through the list. Highlight the correct manufacturer and press [ENTER].

Shortcut: Press the first letter in the manufacturer name. The cursor jumps to the first name in the list that begins with that letter. Press the letter again to scroll through all the names that begin with that letter. Press [ENTER] when the correct manufacturer name is highlighted.

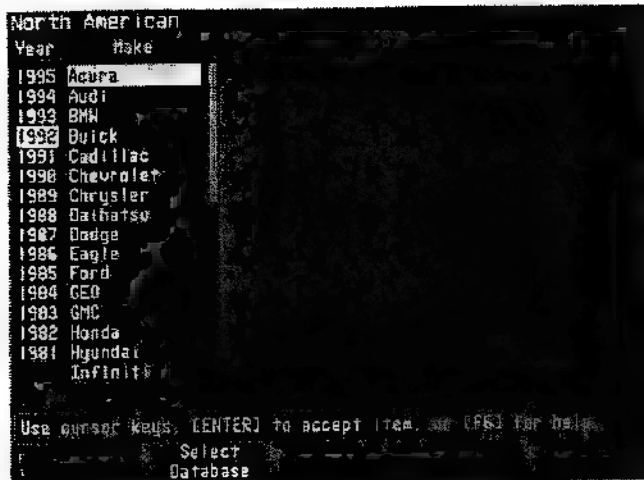


Figure 1-18

4. A list of vehicle models will now pop-up (see Figure 1-19). Use the Arrow Keys to move through the list. Highlight the correct model and press [ENTER].

Shortcut: Press the first letter in the model name. The cursor jumps to the first name in the list that begins with that letter. Press the letter again to scroll through all the names that begin with that letter. Press [ENTER] when the correct model name is highlighted.

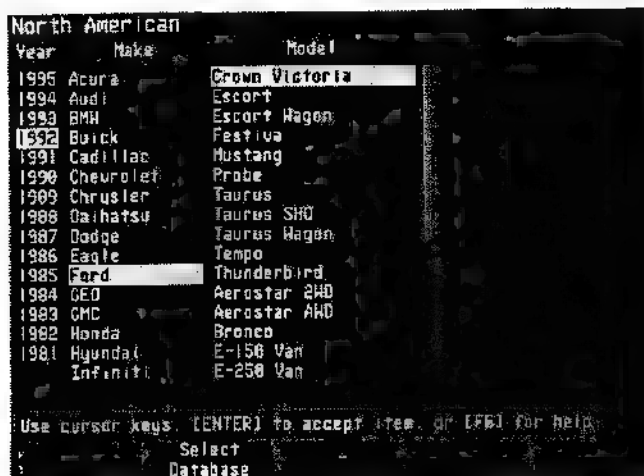


Figure 1-19

NOTE At this point, you may be prompted to make other selections, such as engine size, transmission type and so forth, depending on the vehicle make/model you have chosen.

5. When you have finished selecting vehicle specifications, the analyzer will display a result screen summarizing the data just entered (see Figure 1-20).

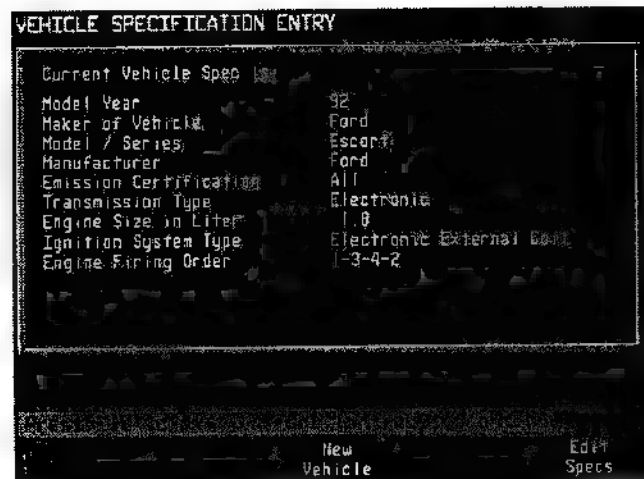


Figure 1-20

Press:

- [F3] – to input new vehicle specifications;
- [F5] – to edit the screen currently in analyzer memory (see the "Editing Specifications" section for complete details).

8. Press [F10] to return to the previous menu screen. The vehicle specifications now appear above the "F-Keys."

Editing Specifications

There may be occasions when the specifications entered into the computer do not match the equipment or systems installed on the vehicle.

To ensure correct results and appropriate diagnostic messages, you can edit the specifications as needed to gain an exact match to the vehicle.

From the Vehicle Specification summary screen, press [F5]. The first of several specification screens will appear (see Figure 1-21).

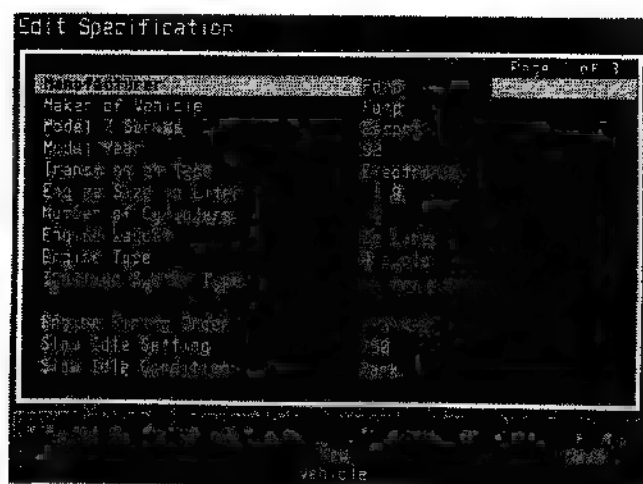


Figure 1-21

Use the Up and Down Arrow Keys to highlight the specification that needs to be changed. For specifications such as *Manufacturer* or *Model Year*, type over the old information. For specifications, such as *Engine Layout* or *Ignition System Type*, press [ENTER] and a dialog box will pop up, providing you with a list of options. Use the up- or down-arrow keys to highlight your choice and press [ENTER].

When you are satisfied with the changes, press:

- [F3] – to select new vehicle specifications;
- [F4] – to display the previous specification screen;
- [F5] – to display the next specification screen;
- [F10] – to save specifications and exit.

Linking Vehicle Specs to Customer Information

If you have forgotten to enter vehicle specifications for a customer, or if you need to change the vehicle specifications attached to any customer, link the Vehicle Specs to the Customer information as follows:

1. From the "Customer Information" screen, press [F1] to enter the "Vehicle Specifications" screen. Note that if a vehicle spec is already loaded in memory, a full summary screen appears. If the full summary screen appears, press [F3] "New Vehicle" to enter the "Vehicle Specifications Entry" screen.
2. Select the vehicle specifications as described previously in *Loading Vehicle Specifications by Year/Make/Model*. When specs are loaded, a result screen similar to Figure 1-20 will appear.
3. At the result screen, press [F10] to return to the "Customer Information" screen again.
4. Press [F10] again to return to the Menu screen. The analyzer will save the information entered in the customer file. The menu screen will display the customer and specifications above the "F" keys.

Quick Spec Entry

Using the Quick Spec Entry method, enter the minimum vehicle specifications needed to test a vehicle.

NOTE

IMPORTANT: Quick Specs will not allow you to run the Quick Comprehensive or Diagnostic Tests, or perform Task Switching. Only Service Tests are available, and no diagnostic messages will be available for these tests.

1. From the Menu Screen, press [F2], "Setup."
2. The "Vehicle Setup/Quick Spec Entry" screen appears, (see Figure 1-22).

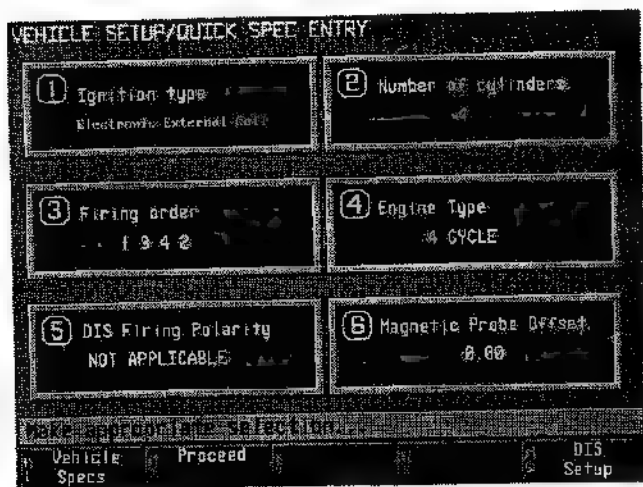


Figure 1-22

3. Press the number key which matches the specification that must be changed. A list of options for that number appears (see Figure 1-23).
4. Use the Arrow Keys to highlight the correct option and press [ENTER].

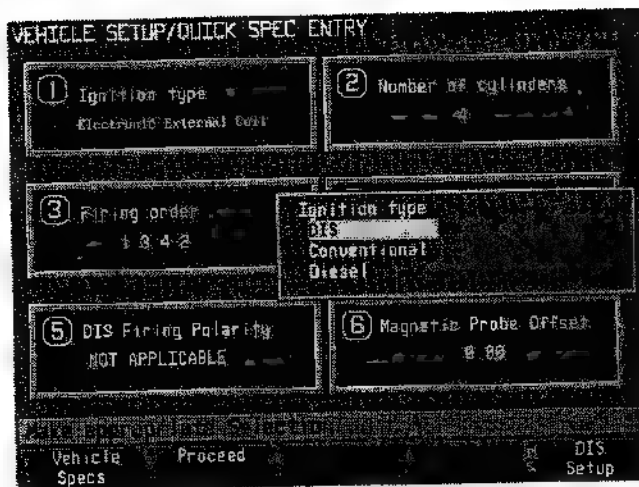


Figure 1-23

NOTE

When you select some of the specifications, such as *Ignition Type* and *Firing Order*, you will be presented with a list of entries to choose from. Other specifications, such as *Number of Cylinders*, will require you to enter a value. For example: To change the number of cylinders, press [2]. The "Cylinders" entry will be highlighted with a flashing cursor. Type the correct number of cylinders and press [ENTER].

There are other options at the Vehicle Setup/Quick Spec Entry screen. Press:

- [F1] – Access the "Vehicle Specs" to change the manufacturer or make entry. When you have finished selecting the vehicle specifications, a Vehicle Specification Entry screen will be displayed (see Figure 1-17). Press [F3] to enter new vehicle specifications, [F5] to edit the existing specifications, or [F10] to return to the Main Menu;

- [F2] – Proceed: return to the Main Menu;
 [F5] – Access the DIS setup screen (see Figure 1-24).

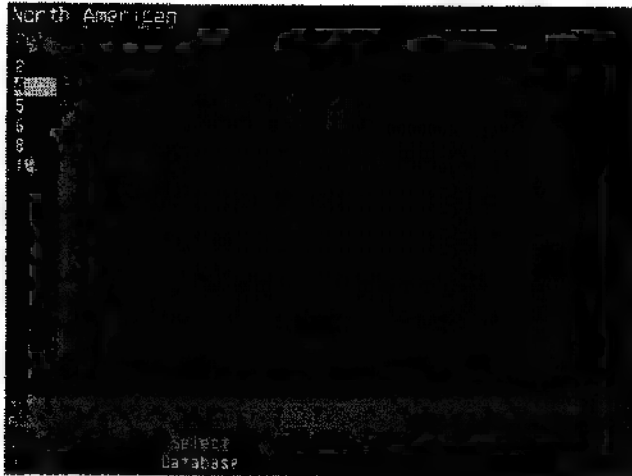


Figure 1-24

You will be required to select the number of cylinders, make and engine description (see Figure 1-25). Press [ENTER] after each selection. When finished, you will be returned to the Vehicle Setup/Quick Spec Entry screen.

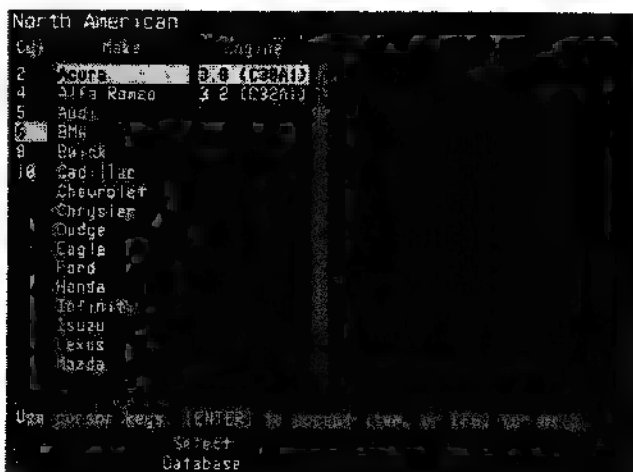


Figure 1-25

Step 4: Select a Test

1. Use the Arrow Keys to move back and forth along the Main Menu bar at the top of the screen. One of four pop-down menus displays on the screen.
2. Use the Up or Down Arrow Keys or press the test number to highlight the test from the pop-down menu.
3. Press [ENTER] to start the test.

Direct Access

Use "Direct Access" to select the exact test you wish to run, without searching for it in the regular menu system.

To display the "Test List," press [F5] from any menu screen. The "Test Direct Access" screen appears, (see Figure 1-26).

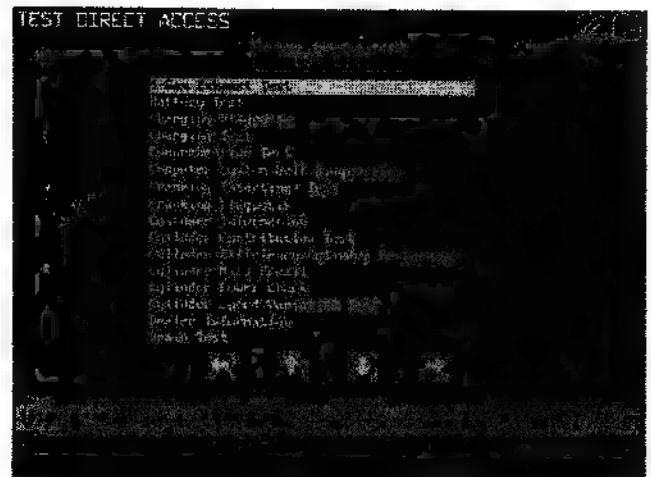


Figure 1-26

Use the Up and Down Arrow Keys to highlight a test. Start the test by pressing [ENTER]. Or press the letter to go the corresponding letter in the list (for example, pressing [S] takes you to the "S" section of the list).

Step 5: Connect the Test Leads

We recommend that you connect all the test leads before running any diagnostic tests. Figure 1-27 shows a conventional ignition lead hookup. Connecting all the leads allows you

maximum efficiency and flexibility in selecting the tests needed to diagnose a problem. It will also ensure accurate test results and correct diagnostic messages from the tests you run.

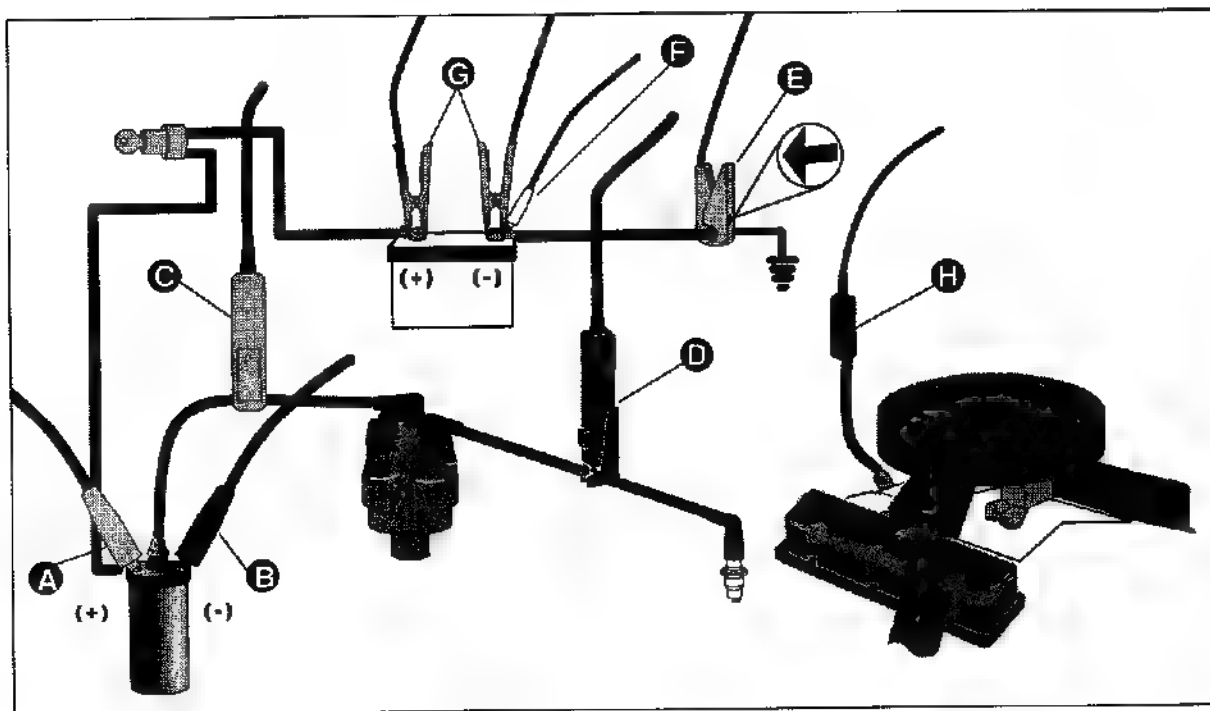


Figure 1-27

- A - Coil Positive** — Connect (yellow) to Positive coil terminal.
- B - Coil Negative** — Connect (blue) to Negative coil terminal.
- C - Secondary Probe** — Place around high tension lead from coil to distributor. Must be completely closed; not touching plug wires, metal parts, vacuum hoses or water. Supplies high voltage information. (Not used in DIS testing.)
- D - Green #1 Probe** — Place around #1 spark plug wire. Supplies cylinder #1 firing information.

- E - Gray Amp Probe** — Place around the positive or negative battery cable. Supplies current information. Clamp must be around all wires to terminal. **NOTE:** Check the arrow on the clamp carefully! If probe is clamped around negative terminal wires, arrow should point toward battery. If probe is clamped around positive terminal wires, arrow should point away from battery.
- F - White Clip** — Connect to Negative battery terminal. Provides system ground.
- G - Positive and Negative Battery Load Leads** — Connect to the battery posts.

Secondary Ignition Adapters

The **H-Clip Adapter** (see Figure 1-28) provides a hookup site for the yellow and blue primary lead clips on late model Ford and GM vehicles.

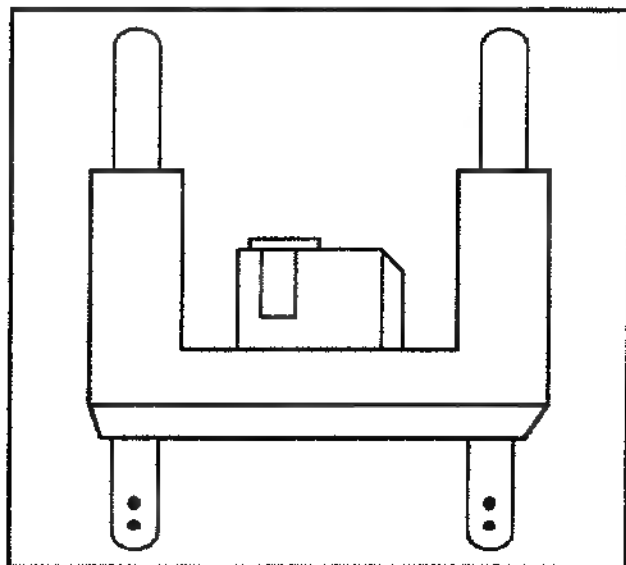


Figure 1-28

Ford: Slip the two dimpled prongs into the distributor coil. Connect the blue clip to the smooth prong on the negative side of the coil. Clip the yellow clip to the smooth prong on the positive side of the coil.

GM: Disconnect the coil wires at the coil. Slip the center connectors of the adapter into the socket where the coil wires were connected. Attach the disconnected coil wires to the dimpled prongs. Then connect the blue clip to the smooth prong on the negative side of the coil. Clip the yellow clip to the smooth prong on the positive side of the coil.

GM H.E.I. Adapter: This adapter is supplied with your Engine Analyzer (see Figure 1-29). The adapter is used in place of the yellow pickup on all GM HEI vehicles equipped with integral coil/distributor systems. Disconnect the yellow pickup from the secondary lead. Plug the HEI adapter into the secondary lead and screw the connector ring over it. Attach the HEI adapter to the vehicle at the coil.

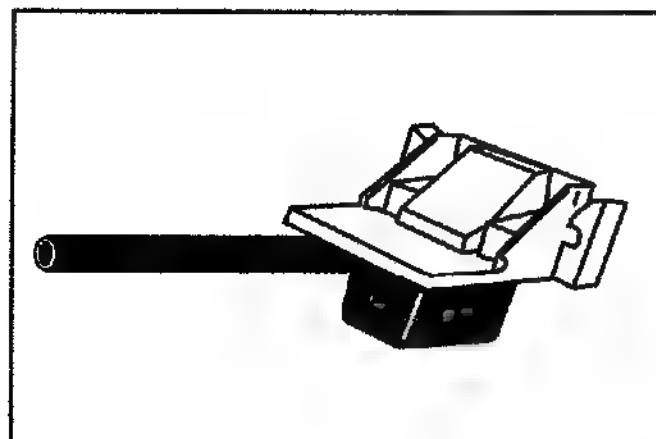


Figure 1-29

Toyota HEI Adapter: Use this adapter probe in place of the standard yellow, high-tension secondary probe.

Attaching the Adapter Probe

1. Align the adapter probe clip (A) with slots and pin on adapter probe (B), then turn counter-clockwise to secure in place. See Figure 1-30.

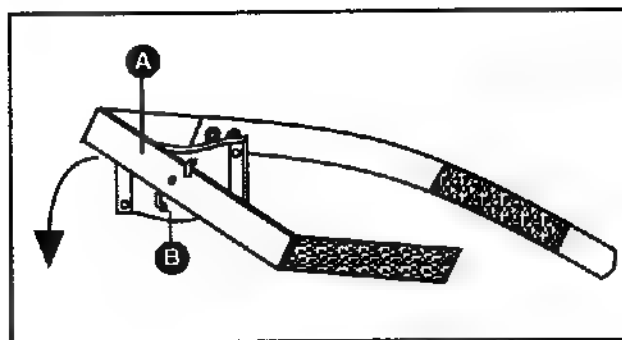


Figure 1-30

2. Place adapter probe on front-center of distributor cap.
3. Wrap adapter probe clip strap tightly around distributor cap, then press velcro ends together to secure (see Figure 1-31).

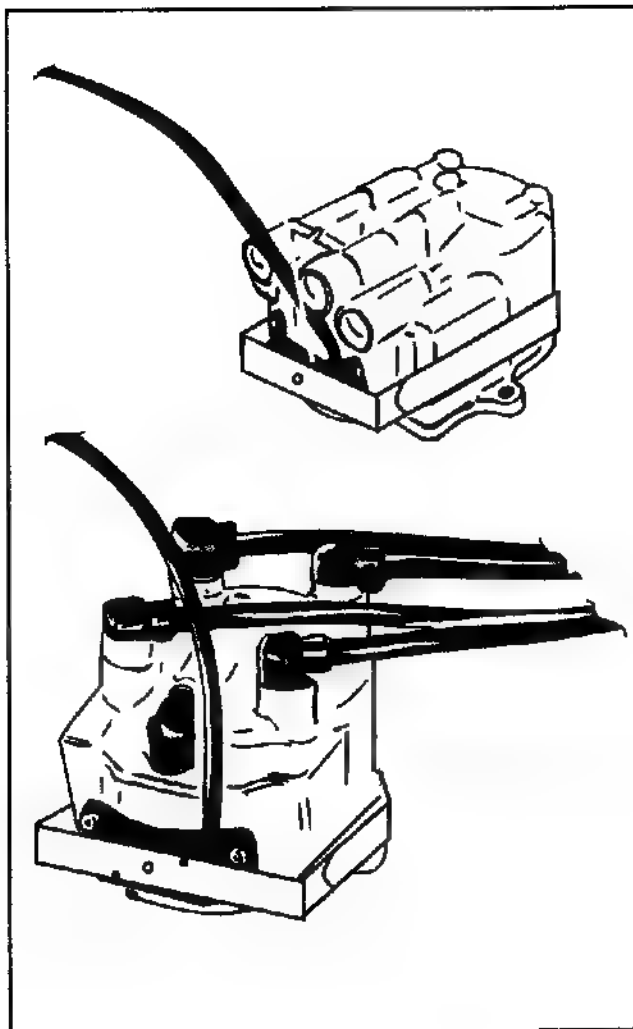


Figure 1-31

Removing the Adapter Probe

1. Pull velcro material apart.
2. Remove adapter probe assembly.

DIS Leads

DIS Secondary Probe Assemblies

There are two secondary probe assemblies. One assembly is positive (red); one is negative (black). Each assembly has four small clips. These must be clipped securely around each spark plug wire on the test vehicle. On 4- and 6-cylinder systems, some clips will be dangling free. Make sure they are not touching the engine block or any other wires. Make sure any extra wires cannot come into contact with a moving fan blade.



Pull vehicle plug wires apart so that they are at least 1" apart from each other. Connect the DIS leads to the plug wires. Make sure that the DIS leads are at least one inch apart from each other and from ground. This prevents "cross talk" between leads.

Figure 1-32 shows some of the common connections required for DIS operation. If RPM readings are unstable, press [F7] and change the trigger type. Choose "Primary" from the trigger box.

Use the low current probe to get the primary signal. Connect the probe around the most direct wire from the ignition switch to the DIS ignition coil module, to avoid noise caused by other components in the circuit. You may have to consult the manual for the vehicle that you are testing to find the correct wire and location to use.

| Make/Ignition Type | Engine Size | Pin Location/Wire Color |
|--------------------|-------------|---|
| Chrysler | 1.6L | Pin 4 - Black/White |
| Chrysler | 3.3L (1990) | Lt. Green/Black |
| Ford DIS | 1.9L (1991) | DIS Triple Spark System |
| Ford DIS | 4.0L, 1.9L | Wire to Pin 8 - EDIS Module |
| Ford DIS | 3.0L, 3.8L | Red/Lt. Green |
| Ford DIS | 2.3L | Pin R2, L2 - Red/Lt. Green |
| GM Type | 3.0L, 3.8L | Pin P - Pink/Black at Coil Connector |
| GM Type | 3.0L, 3.8L | Pin M - Pink/Black at Coil Connector |
| GM Type | 3.3L, 3300 | Pin M - Pink/Black at Coil Connector |
| GM Type | 3.8L, 3800 | Pin P - Pink/Black at Coil Connector (Closest to Alternator) |
| GM CPC | 2.0L, 2.5L | Pink/Black or Solid Red Two Wire Connector (Left Side of Coil) |
| GM CPC | 2.8L | Two Wire Connector - Pink/Black |
| GM IDI | 2.3L | Pin L - Solid Pink Last Pin on Top Row of Connector (Closest to Firewall before Inverting Unit) |
| Mazda | 80 CID | Pin 2 - Black/Yellow |
| Mitsubishi | 1.6L | Pin 4 - Black/White |
| Nissan | 1.8L | Black Wire Loop next to Igniter, Left Front of Motor |
| Saab | 2.0L | #1 Probe around all Four Wires - Blue, Green, Orange and Gray in Ignition Coil Harness |
| Toyota | 3.8L | Pin 4 - Brown Wire Green Connector 4-Wire Connector on Left Side of Coil Unit Cover |

Figure 1-32

Special DIS Secondary Clip Connections

NOTE For the GM 2.3L (QUAD-4) with IDI System, a special procedure is required to connect secondary clips:

GM 2.3L (QUAD-4) —

1. Remove and invert the coil assembly. Reinstall the assembly so coil terminals are accessible.
2. Install plug wires between the coil terminals and the spark plugs. (Order your spark plug adapter kit through Automotive Diagnostics part number 00044431-001. GM also makes a kit for this and it is available from your local dealer.)
3. Clip the secondary clips onto the spark plug leads just installed, according to the polarity setup of the vehicle.

See manufacturer's information for more details on this procedure.

Ford 2.3L — This is a double spark system with a full-time pack that does most of the work, and a part time pack that only operates under certain conditions, for emissions controls. Test these ignition systems in two steps:

1. Connect DIS leads to the full-time pack and run all tests in the usual way.
2. After testing the full-time pack, connect the DIS leads to the part-time pack. Press [F2] and perform a DIS setup routine again, with engine running at idle (the part-time pack is always active at idle). After verifying setup on the part-time pack, run any necessary ignition system tests to check the part-time pack.

NOTE A variety of accessory lead sets are available for DIS and DI vehicles, such as:

DIS 12-Cylinder Lead Set (metal) — 6 Red/Positive and 6 Black/Negative leads work with all secondary ignition cable diameters. Part number B44-112. Requires the B44-102 DIS/DI Extension Harness (see below).

Nissan 1.6L/1.8L DI Secondary Lead Set — Works on all 1.6 Liter and 1.8 Liter Direct Ignition Systems. Part number B44-501. Requires the B44-102 DIS/DI Extension Harness (see below).

Nissan 300ZX/Infiniti J30 DI Secondary Lead Set — Works on all 300ZX and Infiniti J30 Direct Ignition Systems. Part number B44-502. Requires the B44-102 DIS/DI Extension Harness (see below).

BMW Direct Ignition System Lead Set — Works on all 6- and 8-cylinder BMW engines (M-50 and M-60 class) that use individual ignition coils. Part number B44-401. Requires the B44-102 DIS/DI Extension Harness (see below).

DIS Converter All Negative — This adapter converts positive DIS and negative DIS leads to all-negative DIS leads. When used with four positive and four negative, will provide up to eight negative polarity inputs to the engine analyzer. Part number B44-101.

DIS/DI 400 Extension Harness Kit — This 17-foot long extension harness replaces the existing DIS harness at the Engine Analyzer connector. It provides a connector that allows the use of existing 170/270 series Engine Analyzer DIS secondary lead sets. Part number B44-102.

Check the Trigger Lead Status

After connecting the leads to the vehicle, press [F7]. The "Trigger Lead Status" screen will appear. Check the input signals from the leads and the gas analyzer to make sure that they are working correctly.

1. Make sure that the secondary leads are properly connected according to the polarity setup.
2. Make sure each secondary clip is securely connected to its spark plug wire.
3. Make sure the green #1 lead is installed on the #1 cylinder wire, as far away from the DIS module as possible. The lead should be connected between the secondary clip and the plug.

Press [F2] to continue on with testing.

Step 6: Run the Test and Access Diagnostic Messages

Follow the screen prompts. Each test usually provides a "live" screen which allows you to see the current system status. The "live" screen will show you the results of any adjustments that you make.

Whenever the procedural portion of any test is completed and the diagnostic results are displayed, press [F2] to read the diagnostic messages. The diagnostic message screen (see Figure 1-33) lists the possible problem, its causes and a list of suggestions of possible solutions.

Press the Arrows Keys if they appear, to scroll up or down the text. At times, "F Key" prompts will also appear, allowing you to display related diagnostic message screens.

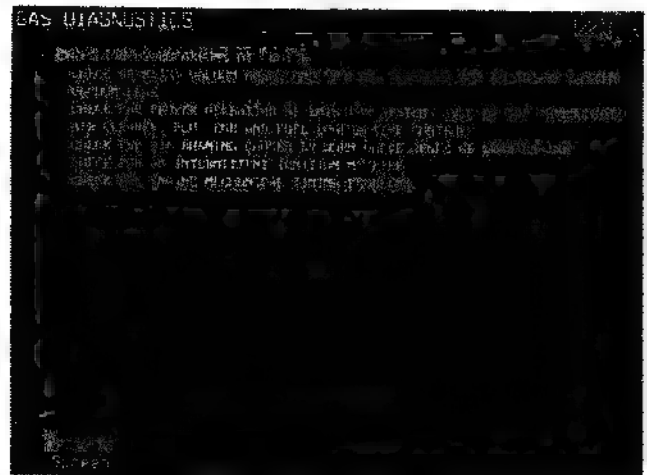


Figure 1-33

Step 7: Print Test Reports

After the diagnostic portion of any test, press [F10]. When the menu screen appears, press [F12]. The "Print Reports" screen will appear (see Figure 1-34).

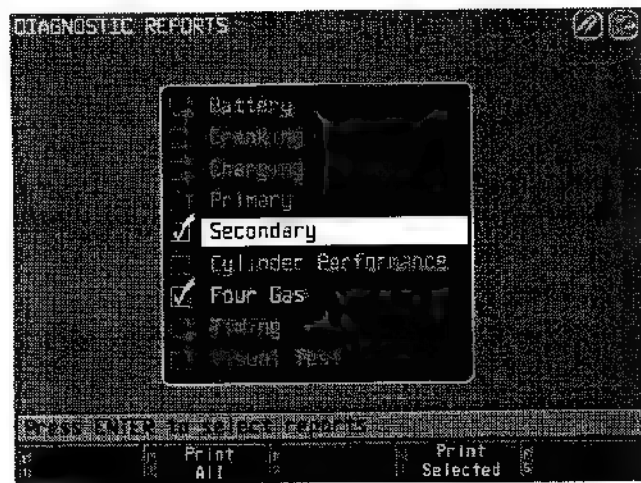


Figure 1-34

The screen lists all of the available reports. Report names in white are ready to print. "Ghosted" reports are not available, because the diagnostic test was not run.

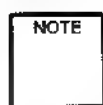
Press:

The Arrow Keys to move the cursor up or down the list;

[ENTER] to select the test(s) to print;

- [F2] – to print all the available tests;
- [F3] – to print the Quick Comprehensive Test Report. This item will appear only if the Quick Comprehensive Test was completed.
- [F4] – to print any test marked by a check mark.
- [F12] – to print the test results for the highlighted system only.

Printed reports will include the station header, (station name, address and sales message, if any - see the "Utilities" chapter for more information), customer information, the test results and the diagnostic messages.



Remember, the reports from the Diagnostic Reports screen will contain the most current data available.

If you run a Quick Comprehensive Test, all of the systems that data was collected for will be white and will contain test results.

If you then run any diagnostic test (from either the Diagnostic Test Menu or the Service Tools Menu), and then press [F12] from any menu screen, all of the items will be highlighted.

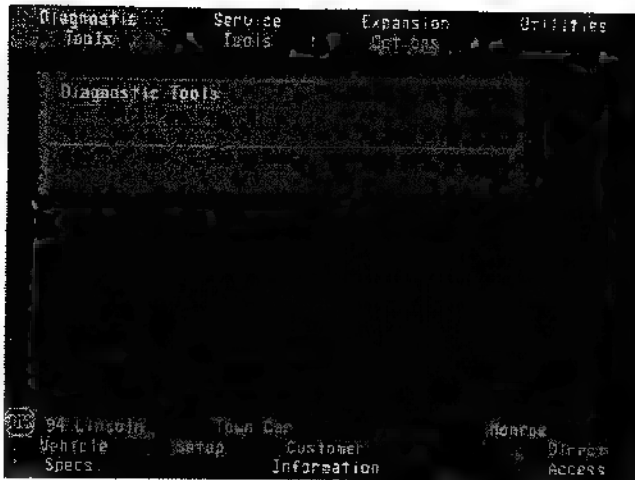
Example: Suppose you run a complete Quick Comprehensive test. Then you run the Primary and Secondary tests from the Diagnostic Test Menu. Your printouts will contain test results as follows:

From the menu screen, press [F12]. The "Reports" screen will appear (refer to Figure 1-34). If you press [F2], the printout will contain all of the most recent data - the results for the Primary and Secondary tests will reflect the Service or Diagnostic tests that you just ran. The other reports however, will contain data from the Quick Comprehensive test that was completed earlier.

If you press [F3] from the Diagnostic Reports screen, the analyzer will print out all of the Quick Comprehensive test results, since they are stored separately from the "Diagnostic Reports" results. If you run another Quick Comprehensive test or load a new customer, all of the test results will be overwritten.

Chapter 2

Diagnostic Tools



Main Icons



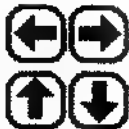
Press [F7] to see Lead Status Screen. Flashing icon indicates problem with one or more leads.



Press [F10] to display previous menu screen.



DIS Specs loaded.



Arrow Keys are active - press the appropriate arrow to scroll up or down a text screen, or change the scale on a meter screen.

The Diagnostic Tools Menu provides several different options for diagnosing vehicle systems:

Quick Comprehensive Test — This semi-automatic test runs a standard series of tests on all vehicle engine systems. This test is designed to run with a minimum of vehicle manipulation on your part.

Symptom Analysis — The operator enters information about symptoms and this program narrows down the possible causes.

Diagnostic Test Menu — This menu provides a specific set of vehicle system diagnostic tests. Each test enters the diagnostic test immediately, without a "live" data screen step.

User Test Menu — This menu can contain up to ten (10) customized test sequences that you design to meet your special needs.

Hot Keys

- [F6] — **Help**—Displays help screens.
- [F7] — **Trigger Lead Status**—Displays *Trigger Lead Status* screen.
- [F8] — **Kill** - Stops the engine.
- [F9] — **Clear** - Clears data fields and displays.
- [F10] — **Previous Menu** - Aborts the test in progress and return to the previous menu or proceed to the next test in a user test.
- [F11] — **Form Feed** - Form feeds paper from the printer.
- [F12] — **Print Reports** - Displays the *Print Reports* menu.
- [Print Screen] — Prints a "screen dump", an exact copy of what appears on the screen.

Quick Comprehensive Test

The *Quick Comprehensive* test is an automatic sequence of system tests, designed to provide an overall look at vehicle performance.

During testing, the computer collects and stores diagnostic information. At the end of testing, this information is provided in complete customer and technical reports. The reports show vehicle performance data compared to specifications. Reports include diagnostic messages, which point out problem areas and discuss possible causes.

The *Quick Comprehensive* test sequence is arranged so that:

- The analyzer provides a clear overall look at performance while vehicle systems are operating;
- Very little manipulation of the vehicle is required;
- Testing of all performance-related systems on the vehicle takes a minimum of time;
- The analyzer provides comprehensive diagnostic messages which are displayed on the screen and/or are printed on any report generated.

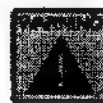
To check specific systems further after running the *Quick Comprehensive* test, select the appropriate test from the *Diagnostic Test Menu*.

The Comprehensive test procedure will vary according to vehicle specifications, as follows:

When a vehicle's specifications do not show a fast idle speed, or when the fast idle speed is the same as the normal idle speed, the *Fast Idle* test will not be performed during comprehensive testing. To perform the *Fast Idle* test on such a vehicle during comprehensive testing, edit the specifications to show a fast idle speed.

If specifications are not entered for *Total Advance Timing* and *Mechanical (Centrifugal) Advance Timing*, the *Basic Timing* test is the **ONLY** test that will be performed. To perform *Total Advance Timing* and *Mechanical Timing* tests, the operator must edit the specifications to show values for these items.

When specifications indicate that ignition timing cannot be adjusted (as in the case of some DIS ignitions), the entire timing procedure is skipped. The *Quick Comprehensive* tests can be run without using the gas analyzer, if desired. However, the tests will not have the benefit of emissions values when determining diagnostics.



Make sure the vehicle cannot roll! Set the parking brake and place transmission in "PARK" or, "NEUTRAL" (manual transmissions only). If necessary, chock the wheels.



The *Quick Comprehensive* menu item will be ghosted (colored gray) until full specs are loaded. You cannot access this function without loading complete vehicle specifications into analyzer memory.

Prepare For Testing

1. Turn the analyzer ON and allow it to warm up.
2. Enter the customer and vehicle specifications. Refer to the "Introduction" chapter for complete details.

NOTE If there is any difference between the emissions control decal information found on the vehicle and the disk-based specifications, use the Edit Specifications screen to enter the emissions decal information.

3. Connect the test leads to the vehicle. Connect all of the leads as shown in Figure 1-26 to give a complete picture of engine performance and diagnostics.
4. Slide the building exhaust removal system hose over the tailpipe. Turn on the exhaust fan. Allow the vehicle to warm up to normal operating temperature.
5. If necessary, turn off all lights and accessories. Make sure the ignition key is "OFF."
6. Select "Quick Comprehensive Test" from the "Diagnostic Tools" menu.
7. The "Trigger Lead Status" screen appears. Check the lead status and make any adjustments necessary.
8. With the remote keypad in hand, press [F2] to begin the test.

NOTE The following section covers the Visual Inspection sequence. It is important to note that Visual Inspection will not appear if it was deselected in the Engine Analyzer Configuration Setup procedure.

Visual Inspection

1. The "Visual Inspection" screen will appear (see Figure 2-1).

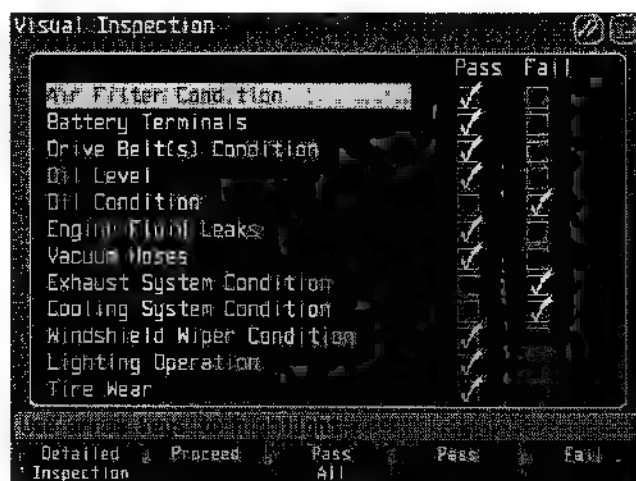


Figure 2-1

Press:

- [F1] – to display the *Detailed Inspection* screen (see Figure 2-2). This screen shows additional items which are part of the system and are highlighted on the *Visual Inspection* screen;
- [F2] – to continue with the *Quick Comprehensive* test;
- [F3] – to pass all of the items on the list. The analyzer places a check mark in all boxes and then continues with the test procedure.
- [F4] – to pass the highlighted item;
- [F5] – to fail the highlighted item.

Use the arrow keys to move the cursor up and down the list. Press the right-arrow key (or [F5]) to "fail" the item. Press the left-arrow key (or [F4]) to "pass" the item.

Press [F1] to create a custom visual inspection menu. The *Detailed Inspection* screen will appear (see Figure 2-2).

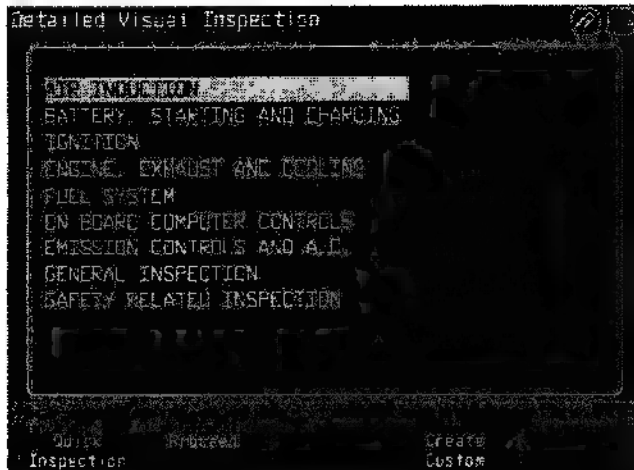


Figure 2-2

Press:

- [F1]** – to return to the *Visual Inspection* screen;
- [F2]** – to continue with the *Quick Comprehensive* test;
- [F4]** – to create a custom visual inspection checklist. Follow the screen prompts and type in the test title and the inspection items. You can make up to ten different lists of up to 20 items each.

It is important to perform a thorough inspection of the test vehicle before running the Quick Comprehensive Test. Checking the vehicle will prevent testing problems caused by obviously bad wires, vacuum lines, fan belts, etc. Use the list which follows as a guide to a visual inspection.

Battery

- Check for loose hold-downs.
- Check electrolyte level; fill if necessary.
- Check cable connections for good contact, cleanliness, excessive corrosion. Clean and tighten as needed.

Battery (continued)

- Check cables for fraying, breaks, poor insulation.
- Check battery case for cracks.

Belts

- Check fan belt for cracks, impending breaks, proper tension; tighten or fix as needed.
- Check all other drive belts in the same way and make necessary corrections.

Fluid Levels

- Check engine oil level and add if necessary.
- Check transmission fluid; add if needed.
- Also check other fluid levels: power steering, brake system, windshield washer, etc.

Filters, Emission Control Devices

- Check air filters (carburetor, air pump, crank-case breathers), PCV, air injection, other emission devices, vacuum control valves, etc.

Electrical Connections

- Check wiring (low and high tension) for cleanliness, tightness, seating, general condition.

Exhaust System

- Check resonator, muffler, exhaust pipes, clamps, tail pipes and catalytic converter for breaks, leaks.

Hoses

- Check all hoses (PCV, heater, radiator, power steering, vacuum, fuel, evaporative control, etc.) for general condition, leaks, cracks, tightness, proper connection, etc.

Radiator and Cap

- Check coolant level; fill as needed.
- Check cap for condition.

Test Procedure

1. The Battery Test screen appears. Follow the screen prompts and enter the Cold Cranking Amps (CCA), if necessary. The battery CCA specification that appears on screen is the minimum value required for the vehicle. If a larger CCA battery is installed in the vehicle, input the higher value in the CCA field.

Press [F5] to change the units. A small menu appears. Choose between any of the following units of measurement:

- CCA** – Cold Cranking Amps
- DIN** – German Institute for Normalization units
- IEC** – International Electrotechnical Commission units
- A-Hrs** – Amp-Hours

Shut the engine OFF. Press [ENTER] to start the test. The battery test will commence (see Figure 2-3).

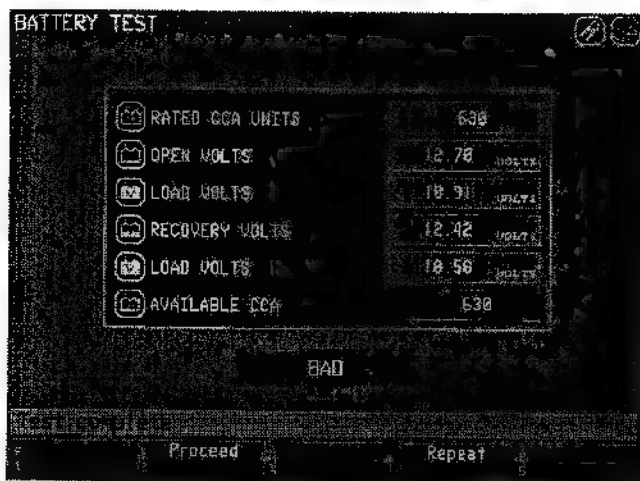


Figure 2-3

2. After the Battery Test is complete, the *Quick Comprehensive* test screen appears (see Figure 2-4). Follow the screen prompts and zero the Light Gray High Amp probe. Press [F2] to continue the test.

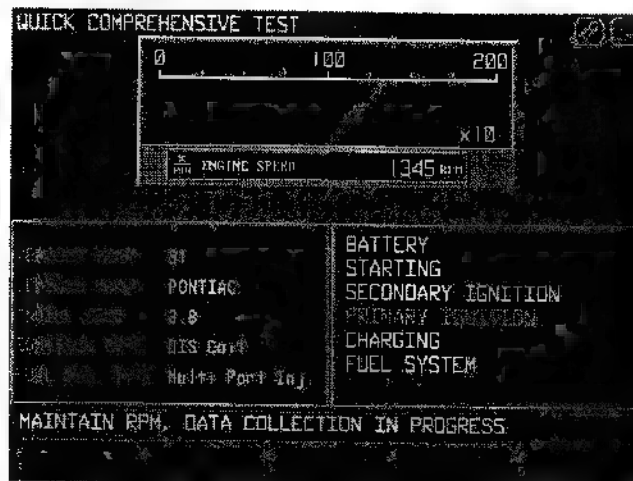


Figure 2-4

As the test runs, the green highlight in the test list box moves up and down, indicating which systems are being tested. The analyzer executes the tests in the most efficient manner, which means that each test will not necessarily be completed in exact order.

After the testing portion is completed, a series of Result screens appear. Figure 2-5 shows the first screen in the series that will usually appear.

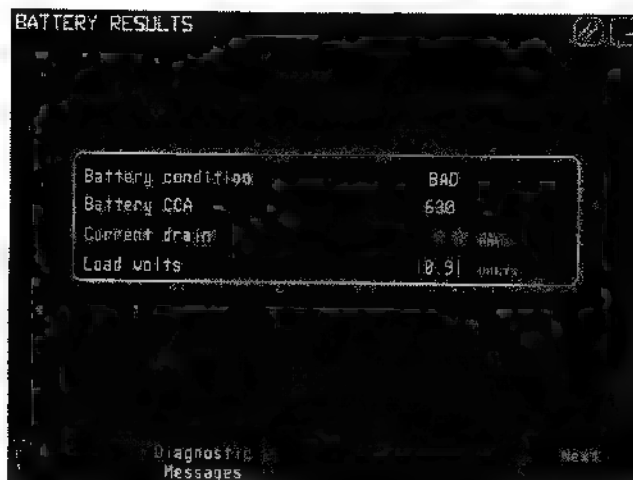


Figure 2-5

Symptom Analysis

Colored data fields indicate test results as follows:

- Green** – good, within specification
- Red** – bad, above or below specification
- Yellow** – marginal
- White** – the analyzer does not diagnose the data.

Press:

- [F2] – Display diagnostic messages relating to this series of tests.

After reviewing the last results screen, press:

- [F10] – to return to the main menu;
- [F12] – to print the test results. For complete details refer to "Print Test Reports" in Chapter 1.

Reviewing Previous Test Results

When you return to the menu screen after completing a *Quick Comprehensive* test, a new "F Key" will appear on the screen. Press [F4] to review the results of the *Quick Comprehensive* test and print out a copy, or copies of the test results.

If you save the test results to disk as a *Quick Comprehensive* Test using the "Save To Disk" function, you can recall the results later. Use the *Retrieve From Disk* function in the *Utilities* menu to reload the record into the analyzer. When you return to the menu screen, the "F4" key will appear, and you can then press [F4] to review and/or print out a copy of the *Quick Comprehensive* test results. The analyzer will print the date that the test was completed on the top of the test result page.

If you retrieve a *Quick Comprehensive* test from disk and then run another test of any type, the *Quick Comprehensive* results will be deleted from analyzer memory (but remain stored on-disk). This prevents the analyzer from using out-of-date data for diagnosis.

Symptom Analysis is a computerized guide to troubleshooting that will help you determine the source of vehicle malfunctions and suggest possible remedies.

A number of symptoms may be selected, ranging from stalling problems to the appearance of exhaust smoke.

After you have selected all observed symptoms and conditions, the computer runs the analysis and displays the results on the screen and/or prints a report.

Procedure

1. Select *Symptom Analysis* from the *Diagnostic Tools* menu.

NOTE If you have not selected a vehicle yet, you will be prompted to select the type of fuel system and whether or not the vehicle has an O₂ sensor (see Figure 2-6). Type the number(s) of your selection(s), then press [F2] to continue.

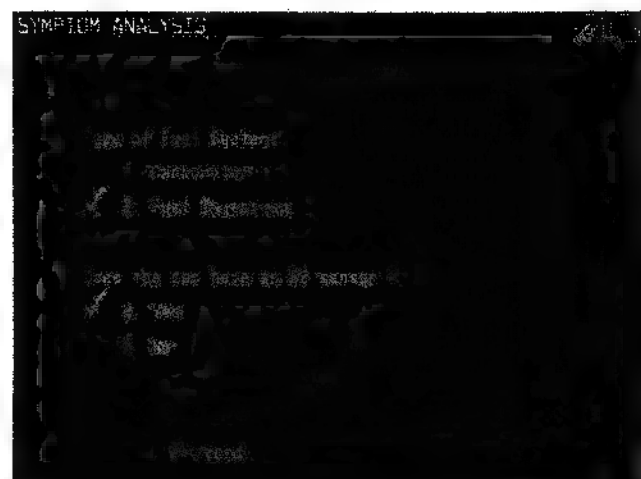


Figure 2-6

A list of symptoms will be displayed (see Figure 2-7).

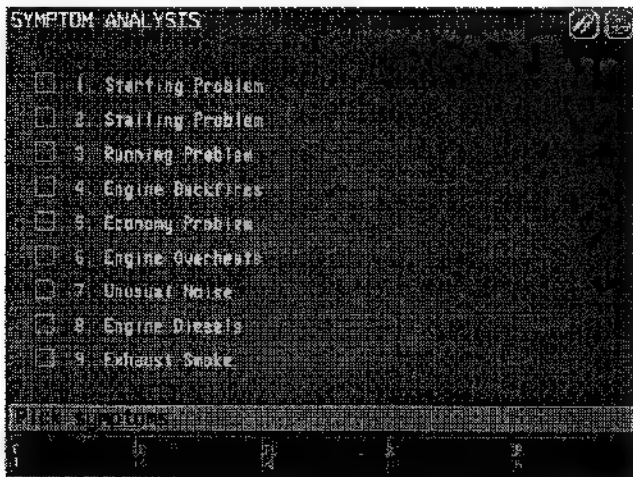


Figure 2-7

2. Press the number next to a symptom in the displayed list that matches the symptom the vehicle shows.
3. When you select certain symptoms, such as *Starting Problem* or *Running Problem*, you will be prompted to select specific symptoms (see Figure 2-8).

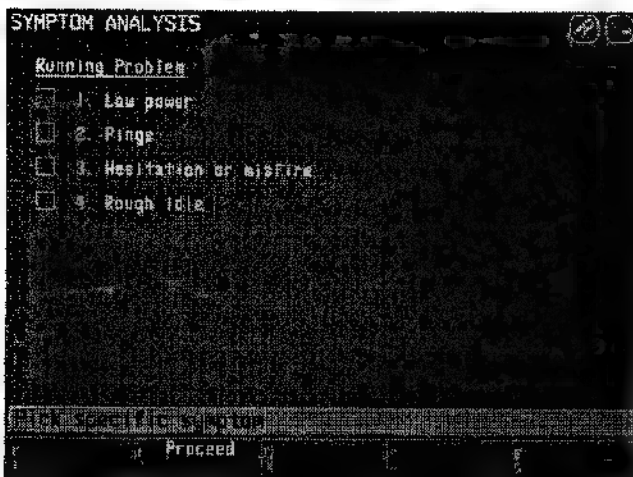


Figure 2-8

Press the number matching the correct specific symptom. When you select certain specific symptoms, such as *Hesitation* or *Misfire*, you will be prompted to select the condition(s) under which the symptom occurs (see Figure 2-9).

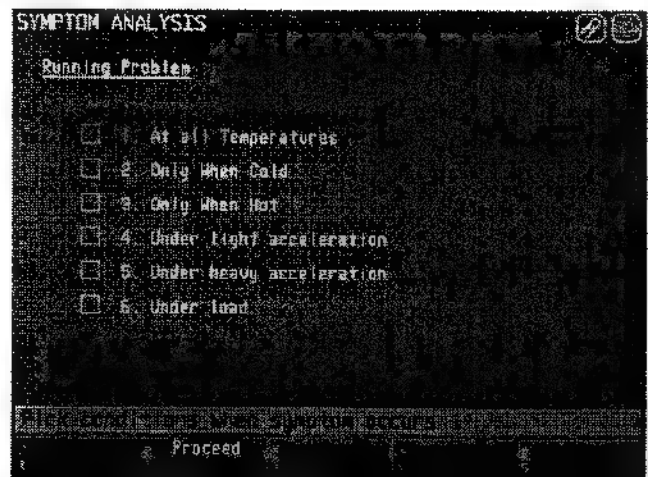
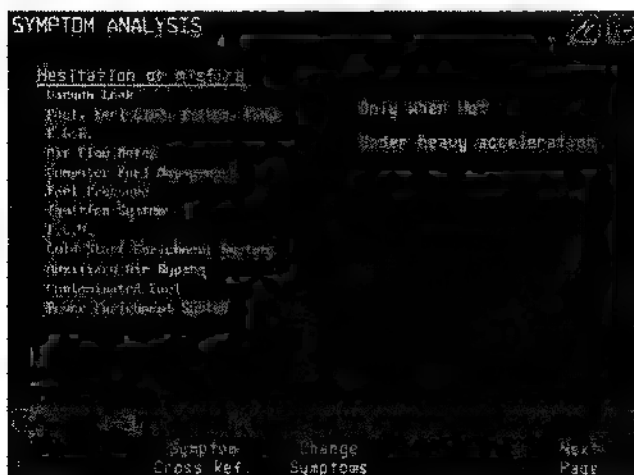


Figure 2-9

You can select more than one condition. Press the number(s) matching the correct condition(s).

4. When finished, press:
 - [F1] – to run the analysis;
 - [F2] – to continue to the symptom selection list and pick additional symptoms that are occurring.
5. Follow the prompts on the next screens and confirm the vehicle symptoms and conditions. Observe the "F Keys" at the bottom of the screen and either confirm the information (press [F2] - "Yes") or make changes (press [F4] - "No" and then re-select). When finished, press [F2]. The analyzer computer will run the diagnostic routine and will display an analysis on the screen.

If you have chosen a single symptom, the screen will appear as shown in Figure 2-10.

**Figure 2-10**

Press:

- [F2]** – return to the previous *Symptom Analysis* screen;
- [F3]** – to change the symptoms;
- [F5]** – go to the next page of symptom analysis;
- [F10]** – to return to the *Diagnostic Tools* menu;
- [F12]** – to print a *Symptom Analysis* report on the printer.

If you have chosen multiple symptoms, the chart shown in Figure 2-11 will appear.

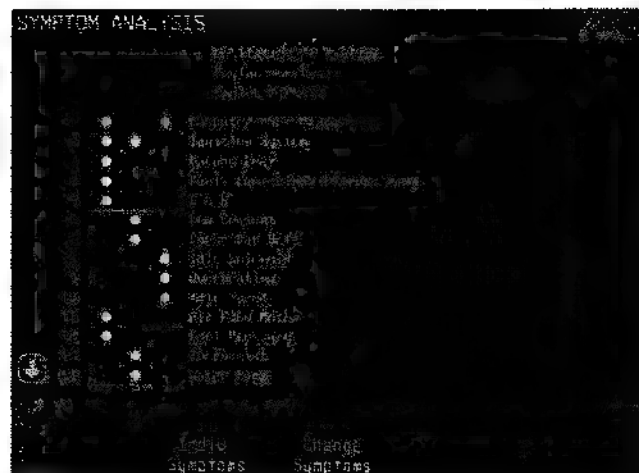


Figure 2-11

The circles inside the boxes indicate which components might be causing one or more of the symptoms you have selected.

The chart is weighted - the components most likely to be causing the problem are listed first.

Press:

- The Arrow Keys** – to scroll up and down the “cause” list;
- [F2]** – to display the individual symptoms on a screen that looks similar to Figure 2-10;
- [F3]** – to return to the *Symptoms List* to choose another symptom;
- [F10]** – to return to the *Diagnostic Tools* menu;
- [F12]** – to print a hard copy of the entire chart.

Diagnostic Test Menu

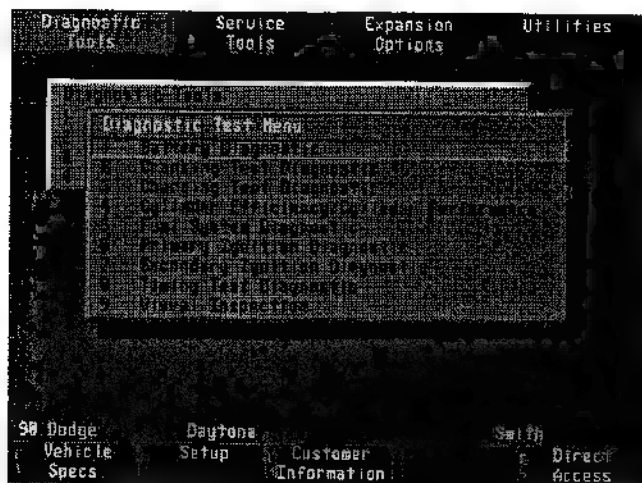


Figure 2-12

This menu provides you with a selection of diagnostic routines for testing vehicle systems. Each of these routines immediately enters a diagnostic routine, which will run the test, provide diagnostic messages and test results which can be printed out.

Use the Arrow Keys to select the test or type the number of the test you wish to run. Press [ENTER] to start each test.

Battery Diagnostic Overview

This routine is designed to test and report on the condition of any 12-volt automotive battery. The test reports the following data:

- Available CCA** — (Cold Cranking Amps) from the battery.
- Open Circuit Voltage** — measured at the battery positive and negative terminals.
- Load Voltage** — measured at the battery positive and negative terminals while a load is placed on the battery.
- Recovery Voltage** — measured at the positive and negative terminals during a period of time after the load is removed from the battery.

Minimum Leads Required:

- Battery Load Leads on battery terminals.

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

Test Procedure

1. Follow the screen prompt and type in the battery CCA rating. If you are not sure of the battery's rating, refer to a battery application manual, or enter the numbers per the chart below.

| No. of Cylinders | CCA |
|------------------|-----|
| 4 | 400 |
| 6 | 500 |
| 8 | 575 |

Type in the CCA Rating and press [ENTER]. To change the battery rating units, press [F5]. The *Battery Rating Units* screen will appear. Type the number which matches the rating units you will use. The available units:

- CCA** – Cold Cranking Amps;
- DIN** – German Institute for Standardization units;
- IEC** – International Electrotechnical Commission units;
- A-HR** – Amp-Hours.

2. The test will run and the results screen will appear (see Figure 2-13).

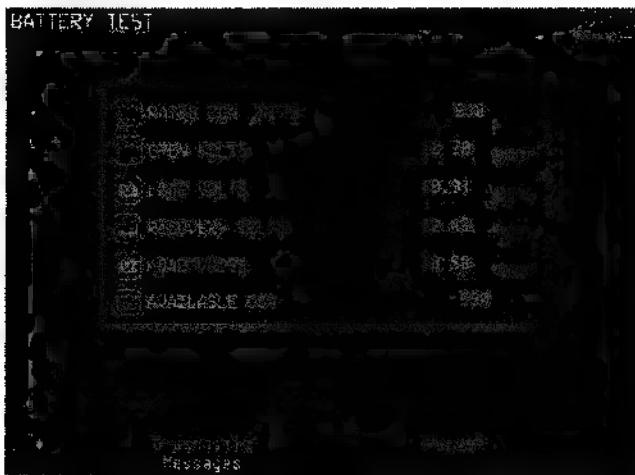


Figure 2-13

Results in green are within specification. Results in yellow are marginal - no diagnostics are available. Results in red are above or below acceptable established limits. If the results appear in white, there are no diagnostics available because Vehicle Specifications were not entered.

Press:

- [F2]** – to display the diagnostic messages;
- [F4]** – to run the test again;
- [F10]** – to return to the *Diagnostic Test Menu*;
- [F12]** – to access the *Print Reports* menu.

Cranking Test Diagnostic Conventional Ignitions



Place the transmission in "PARK" or, if manual, "NEUTRAL." Set the parking brake. Make sure the vehicle cannot roll. If necessary, chock the wheels.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Amps Probe

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

1. If the engine is running when you select the test, the analyzer will inhibit the ignition and shut off the engine. Follow the screen prompt (see Figure 2-14) and crank the engine until it starts.

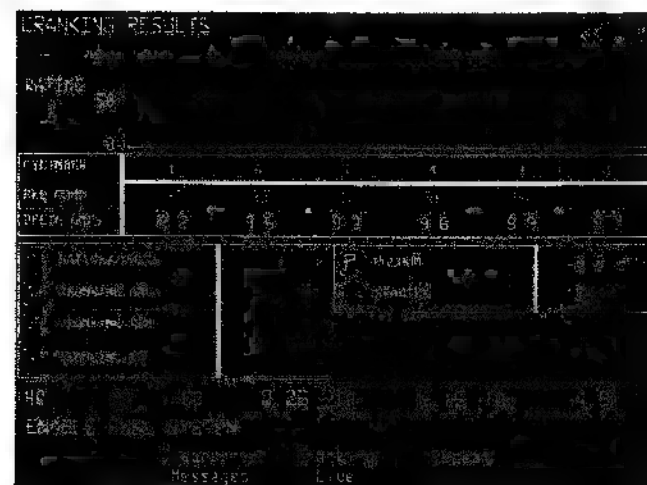


Figure 2-14

Press:

- [F2] – to display diagnostic messages, after the engine starts;
- [F3] – to display the *Cranking Live* screen;
- [F4] – to repeat the test.

When you press [F3], a *Cranking Live* screen appears (see Figure 2-15). Use this screen to make sure that all leads and vehicle components are working correctly. If the “AMP” digital meter shows a high or negative reading, zero the light gray amp probe.

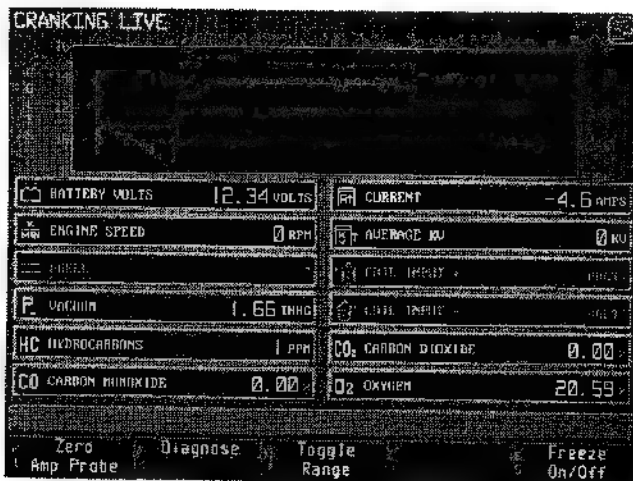


Figure 2-15

Press:

- [F1] – to zero the amp probe;
- [F2] – to run the diagnostic routine;
- [F3] – to toggle the ranges of the data displayed between high and low scales;
- [F4] – default is to “On”, which “kills” the ignition system (conventional ignitions only), press to remove inhibit and allow engine to start;
- [F5] – to freeze data.

Direct Ignition Systems (DIS)



Place transmission in “PARK” or, if manual, “NEUTRAL.” Set the parking brake. Make sure the vehicle cannot roll. If necessary, chock the wheels.

Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Low Current Probe
- Amp Probe

Follow the screen prompt and disable the fuel system as described below. Then crank the engine until it starts and press [F2] to display Diagnostic Messages.

Ported Fuel Injection (PFI) with Clear Flood Mode, and Sequential Fuel Injection (SEFI) with Clear Flood Mode

1. Turn the ignition key to the RUN Position.
2. Depress the Accelerator all the way to WIDE OPEN THROTTLE.
3. Begin cranking the engine until prompted to enable fuel system.
4. Release the Accelerator and continue cranking until the engine starts.



If the engine starts during Step 3, immediately release the accelerator pedal and retest.

Ported Fuel Injection (PFI) without Clear Flood Mode, and Sequential Fuel Injection (SEFI) without Clear Flood Mode

1. Disconnect the Fuel Pump Relay or Inertia Switch.
2. Run the engine until all fuel is exhausted from the fuel system.
3. Follow the screen prompts.

Throttle Body Injection (TBI) and Central Fuel Injection (CFI)

1. Disconnect the fuel injector connector(s) at the fuel injector.
2. Run the engine until all fuel is exhausted from the fuel system.
3. Follow the screen prompts.

Disabling Carbureted Fuel Systems

Carburetor with Electric Fuel Pump

1. Disconnect fuel pump relay or wiring connector to fuel pump.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts.

Carburetor with Mechanical Fuel Pump

1. Crimp rubber fuel inlet hose with hose pliers.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts.

Carburetor with Decel Valve

1. Disconnect decel valve per manufacturers recommendations.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts.

Charging Test Diagnostic

Overview

The Charging Test allows you to measure the alternator output under a load condition. This test also provides you the tools necessary to check the diode condition.

Conventional Ignitions

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Amp Probe

Recommended Lead Hookup:

- Complete hookup per Figure 1-27.

Direct Ignition Systems (DIS)

Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Secondary DIS High Tension Adapters
- Amp Probe
- Low Current Probe (required only if there is an inadequate secondary signal. In that case, the low current probe should be connected to the B+ ignition module.)

Test Procedure



Place the transmission in "PARK" or, if manual, "NEUTRAL." Set the parking brake. Make sure the vehicle cannot roll. If necessary, chock the wheels.

1. Follow the screen prompt and run the engine at 2000 RPM. The green line on the graph represents voltage. The gray line represents alternator amps.

NOTE

If the alternator amps are over 20, a timer will appear on the screen. The test may then take up to thirty seconds to complete.

The analyzer will then place a load on the battery and then allow the battery to stabilize.

2. Follow the next screen prompt and run the engine at idle. The analyzer will then apply a load to the battery.

The diode pattern will appear on the screen (see Figure 2-16).

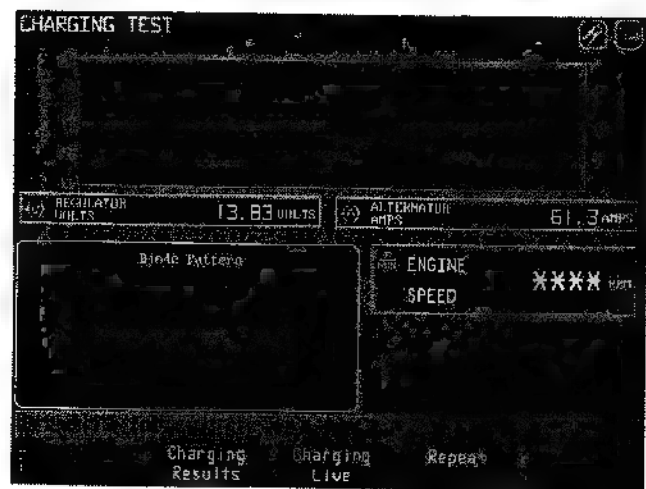


Figure 2-16

Press:

- [F2] – to display the *Results* screen;
- [F3] – to display the *Charging Live* screen;
- [F4] – to repeat the test.

Results Screen

When you press [F2] the *Results* screen appears (see Figure 2-17).

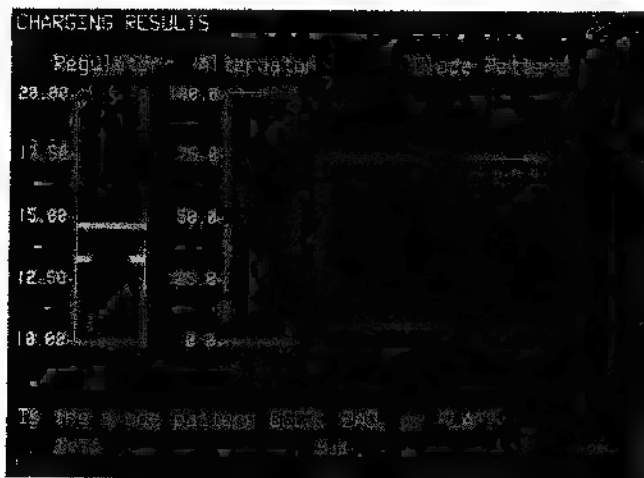


Figure 2-17

The gray bars represent the actual readings. The yellow bars on the "Regulator" graph represent marginal readings. For acceptable results, the gray bar should appear well inside the green area on both graphs. The digital readings shown below the graphs will also indicate whether the results are acceptable. Readings outside specified limits will appear in red.

The analyzer then prompts you to judge the diode pattern. Refer to Figure 2-18.

Press:

- [F1] - to indicate the diode pattern is good;
- [F3] - to indicate the diode pattern is bad;
- [F5] - to indicate the diode pattern is flat.

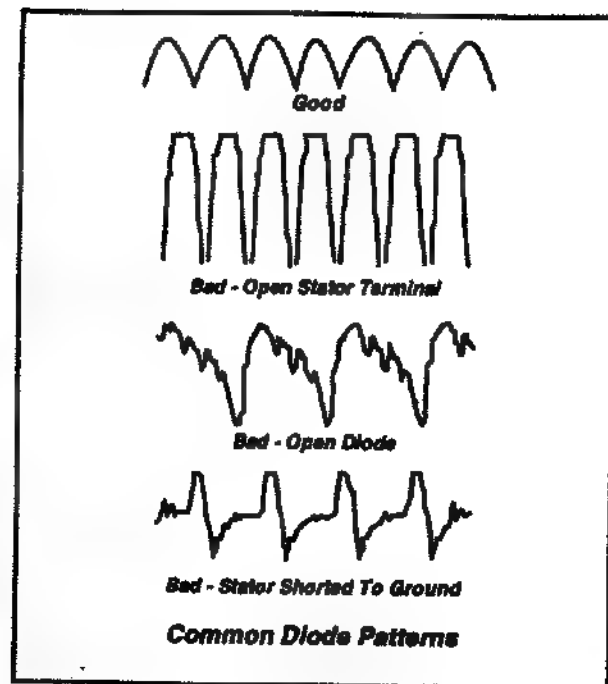


Figure 2-18

A good pattern will show regular, even waves, with some variation acceptable. A bad pattern has uneven or irregularly shaped waves. A flat pattern indicates the alternator is not working at all.

After you indicate the pattern condition, press:

- [F2] -to display the diagnostic messages;
- [F3] -display the *Charging Live* screen;
- [F10] -to return to the *Diagnostic Tools* menu;
- [F12] -to print the test report.

Charging Live Screen

When you press [F3], a *Charging Live* screen appears (see Figure 2-19). Use this screen to make sure all leads and vehicle components are working correctly. If the "AMP" digital meter shows a high or negative reading, zero the amp probe.

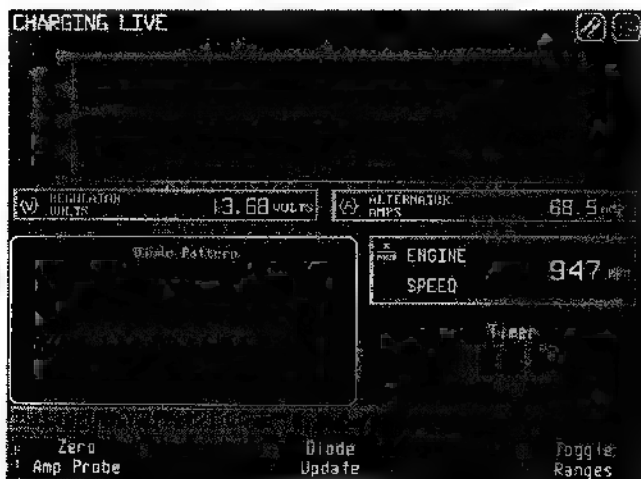


Figure 2-19

Press:

- [F1] – to zero the amp probe;
- [F3] – to update the diode pattern which appears on the screen;
- [F5] – to toggle the scales on the data display between a high and low scale.



If it is necessary to zero the amp probe, remove the probe from the vehicle and completely close the probe jaws. After the analyzer completes the *Zero Amp Probe* procedure, replace the probe, making sure it is clamped around ALL of the negative battery leads! Check the arrow on the clamp carefully. If the probe is clamped around the negative terminal wires, the arrow should point toward the battery. If the probe is clamped around the positive terminal wires, the arrow should point away from the battery.

Cylinder Efficiency/Performance

Cylinder Efficiency (Conventional Ignitions)

The Cylinder Efficiency test measures the relative power contribution of each cylinder to overall engine performance. The test measures power lost when each cylinder is inhibited. Then the computer calculates the relative contribution of each cylinder and displays that information on the screen in the form of a bar graph.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Vacuum/Pressure Transducer

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

Select *Cylinder Efficiency/Cylinder Performance* from the *Diagnostic Test Menu*. The *Cylinder Efficiency* data screen will appear with the message "Shorting Cylinder # n" (where 'n' is the number of the cylinder). Each cylinder will be shorted (in engine firing order) as the data is collected from it.

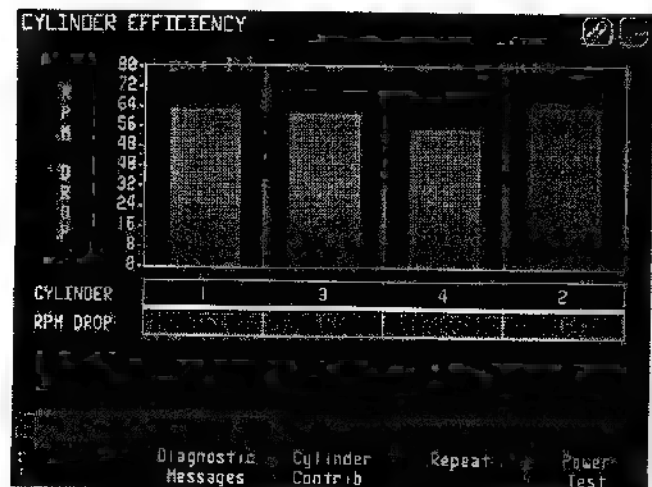


Figure 2-20

After the data has been collected, the computer calculates the results and displays the RPM Drop Values in the boxes under the graph (see Figure 2-20).

Press:

- [F2] – to display Diagnostics;
- [F3] – to display the *Cylinder Contribution* screen (the "live" screen for this test);
- [F4] – to repeat the *Cylinder Efficiency* test;
- [F5] – to run the *Power* test.

The vertical bars represent the power LOST when a cylinder is "killed." The taller the bar, the greater the power loss. There is a bar for each cylinder, arranged in engine firing order.

The light blue box which appears behind the green bars represents the average RPM for the vehicle. Any bars which appear in red are below the average, and represent a weak cylinder.

Cylinder Contribution

This screen displays the live RPM readings for each cylinder, (see Figure 2-21).

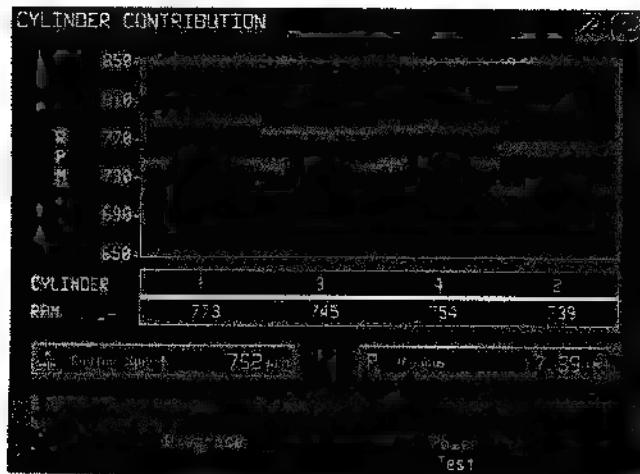


Figure 2-21

The gray bars represent the minimum and maximum readings for each cylinder.

Press:

- [F2] – to run the *Cylinder Efficiency* test;
- [F4] – to run the *Power* test;
- [F9] – to clear the display and begin displaying new information.

The *Cylinder Contribution* screen represents the "Live" screen for this Diagnostic test.

Power Check

Power Check allows the operator to "kill" cylinders and watch the resulting changes in engine RPM, HC, CO, CO₂ and O₂. This information allows the operator to evaluate the performance of individual cylinders. This test will provide better results on older engines or on engines which are running roughly.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Exhaust Gas Analyzer Lead

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.



Power Check does NOT apply to DIS systems.



Some computer-controlled fuel management systems attempt to compensate for RPM loss during *Power Check*. You can often disable this compensating feature according to the vehicle manufacturer's instructions. However, it may be easier to run a *Cylinder Efficiency* test, which will not trigger the computer compensation.

Even if the engine is computer controlled, you may want to run the *Power Check*. If the computer is working properly, you will see the RPM compensation as cylinders are inhibited.

When finished, remember to re-connect any components disconnected from the vehicle.

The *Power Check* screen appears, (see Figure 2-22).

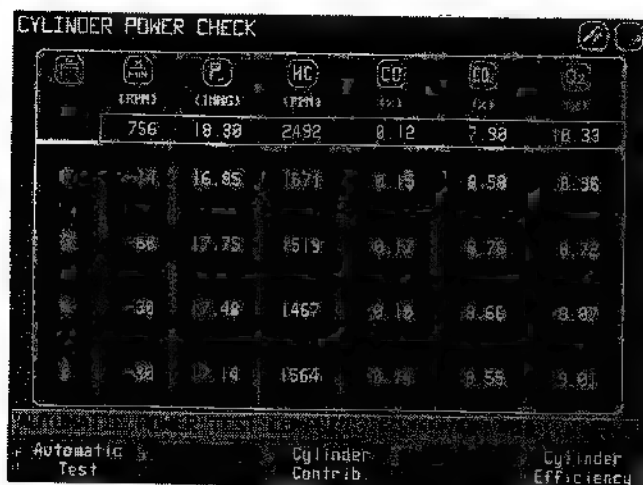


Figure 2-22

Follow the screen prompt or press:

- [F1] — to toggle between "Manual" and "Automatic" testing;
- [F3] — to return to the *Cylinder Contribution* screen;
- [F5] — to run the *Cylinder Efficiency* test.

Automatic Testing

The automatic sequence will inhibit each cylinder in firing order, one at a time.

Manual Testing

Make sure that the engine is running at a stable RPM. For manual testing, type in the cylinder number(s) to inhibit. The analyzer then inhibits the cylinder and displays the various readings on the chart on the screen. Type the number of an inhibited cylinder to release that cylinder.

Cylinder Performance (DIS Vehicles)

If you enter specifications for a DIS vehicle, the analyzer will automatically run the *Cylinder Performance* test. The computer calculates the relative contribution of each cylinder and displays that information on the screen in the form of a bar graph.

Required Lead Hookup:

- Green #1 Lead
- Secondary DIS High Tension Adapters
- System Ground Lead (White)

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.
1. The *Cylinder Performance* meter screen appears (see Figure 2-23). Follow the instructions on the screen, start the vehicle's engine and adjust the RPM reading to fall within the shadowed meter range on the screen.
 2. Once the RPM is stable within the specified range, the message "Retrieving Cylinder Performance Data" appears.
 3. When the analyzer is finished collecting data, the *Cylinder Performance* data screen appears (see Figure 2-24).

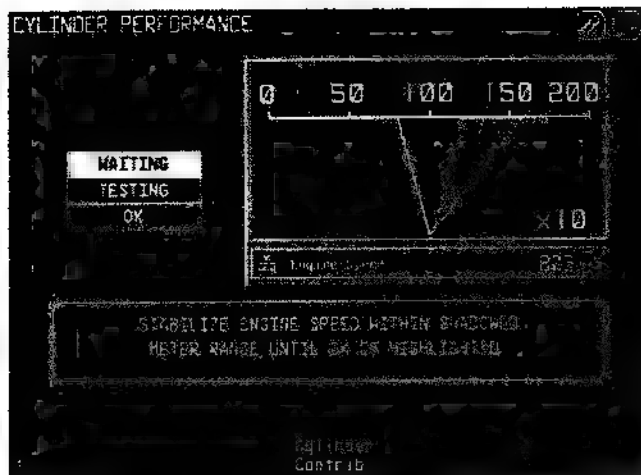


Figure 2-23

The light blue box which appears behind the green bars represents the average RPM for the vehicle. Any bars which appear in red are below the average, and represent a weak cylinder.

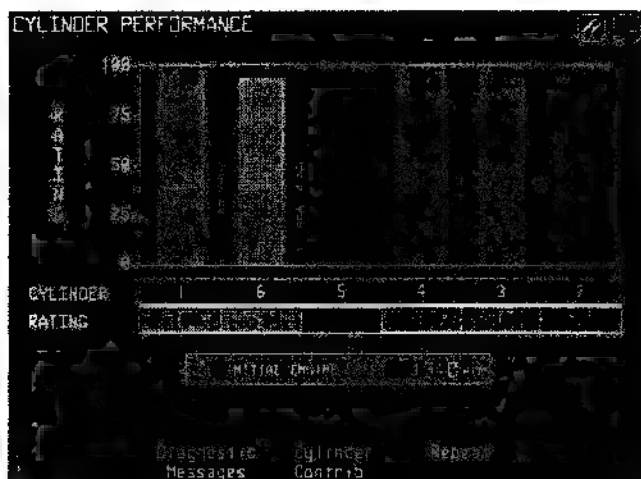


Figure 2-24

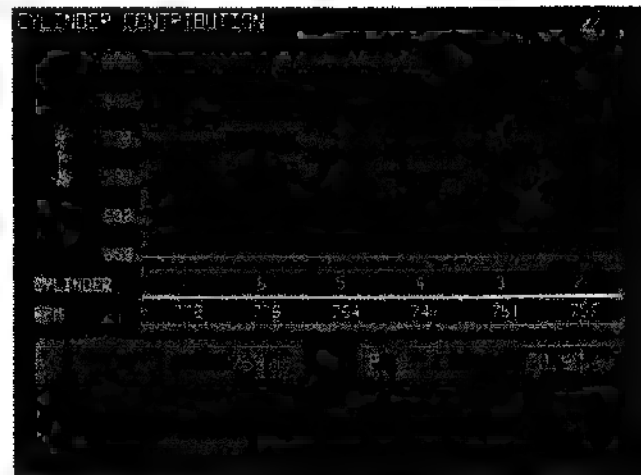


Figure 2-25

5. The vertical green bars represent the contribution of each cylinder to overall engine performance, in the form of individual cylinder RPM. The horizontal gray bars behind the green bars display constantly updated minimum and maximum RPM values for each cylinder during the test run.

4. Press [F3] to display the *Cylinder Contribution* screen, the "live" screen for this test (see Figure 2-25).

Fuel System Diagnostic

This test displays exhaust gas readings for the vehicle at both idle and cruise RPM.

Conventional Ignitions

Required Analyzer Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Exhaust Gas Analyzer Probe
- Secondary Lead and Adapter

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

Direct Ignition Systems

Required Analyzer Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Low Current Probe
- Amp Probe
- Exhaust Gas Analyzer Probe

1. Start the engine, if necessary. Follow the screen prompts and run the engine at cruise RPM. Watch the RPM box - red numbers indicate the RPM is too high, or too low. Green numbers indicate that the readings are within the test limits. When the analyzer detects a stable cruise RPM, the high speed portion of the test will run.
2. Follow the screen prompt and adjust the vehicle's engine to run at the manufacturer's idle RPM. When the analyzer detects an RPM within spec, the analyzer will read the RPM and dilution values, and will display the results on the screen, with a shadow function to show the acceptable range (see Figure 2-26).

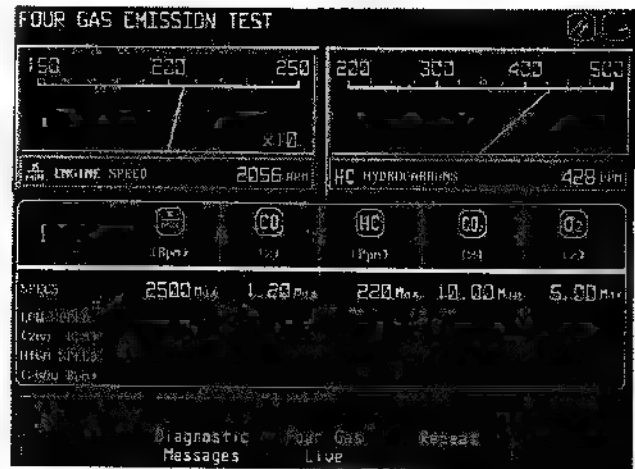


Figure 2-26

Press:

- [F2] – to display diagnostics;
- [F3] – to display the "Live" screen;
- [F4] – to repeat the test. The Engine Speed meter on the left side will always be displayed. Press [F5] to toggle the right meter through each exhaust gas.

Primary Ignition Diagnostic

The Primary Ignition Diagnostic Test collects primary ignition data at idle speed.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

The test automatically runs once it is selected. The screen shown in Figure 2-27 appears.

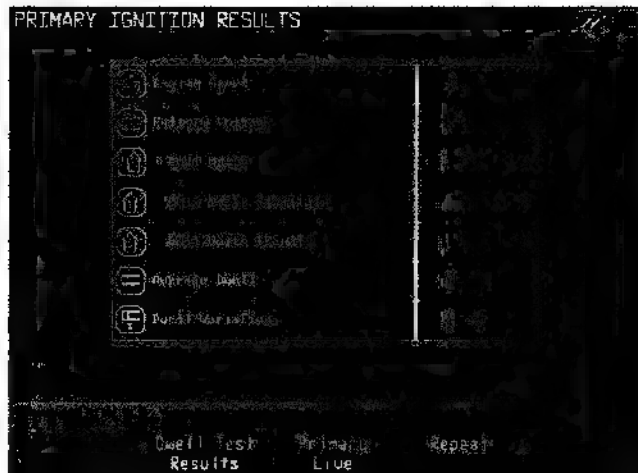


Figure 2-27

Press:

- [F2] – to display the *Dwell Test Results* screen;
- [F3] – to display the *Primary Live* screen;
- [F4] – to repeat the test.

From the *Dwell Test Results* screen (see Figure 2-28), press:

- [F1] – to backup and review the *Primary Ignition Results* screen;
- [F2] – to read the Diagnostic Messages;
- [F3] – to display the *Primary Ignition Live* screen;
- [F4] – to repeat the test.

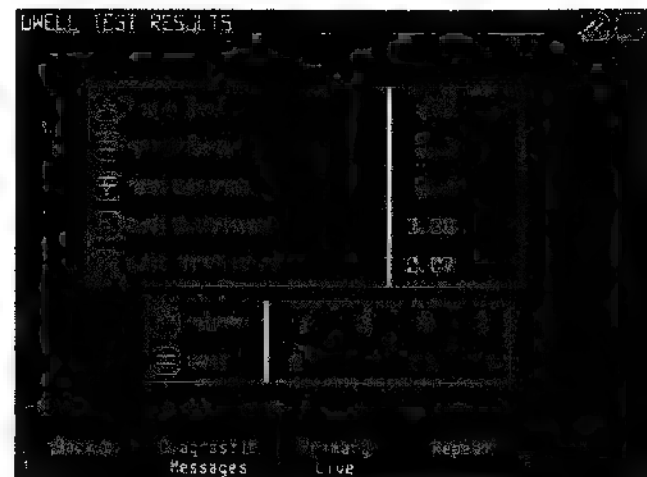


Figure 2-28

From the *Primary Live* screen (see Figure 2-29), press:

Left- and Right-Arrow keys – to select the active meter;

- [F1] – to turn the meter trace (used to show trends) "On" and "Off";
- [F2] – to read the diagnostic messages;
- [F3] – to zero-center the active meter.

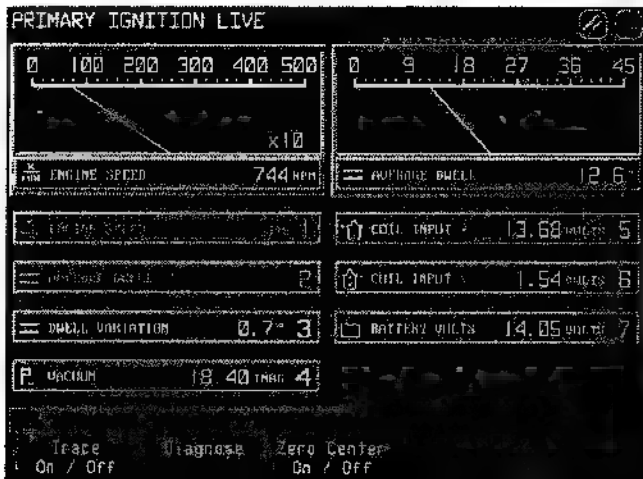


Figure 2-29

Test Result Definitions

Battery Volts — The voltage measured at the battery's positive and negative terminals.

Coil Input + — The voltage measured at the positive terminal of the ignition coil. This measurement is an average of several readings prior to the "Points Open / Transistor Off" portion of the primary pattern.

- Coil Volts — The voltage measured at the negative terminal of the ignition coil. This measurement is an average of several readings just after the "Points Close / Transistor On" portion of the primary pattern.

- Coil Volts (Final) — The voltage measured at the negative terminal of the ignition coil. This measurement is an average of several readings just before the "Points Open / Transistor Off" portion of the primary pattern.

Average Dwell — Each cylinder's average dwell over one distributor revolution. DWELL is the time period measured in degrees or percent that current is flowing in the primary ignition circuit.

Dwell Variation — The Maximum Cylinder Dwell and Minimum Cylinder Dwell during one distributor revolution.

Dwell Test Result Definitions

Average Dwell — The average of each cylinder's dwell over one distributor revolution. DWELL is the period of time measured in degrees or percent that current is flowing in the primary ignition circuit.

Dwell Variation — The Maximum Cylinder Dwell and Minimum Cylinder Dwell during one distributor revolution.

Dwell On Variation — The variation in degrees or percent of the DWELL ON signal. This measurement relates to variations of when the points close or the electronic module turns on to provide power to the ignition coil.

Dwell Off Variation — The variation in degrees or percent of the DWELL OFF signal. This measurement relates to variations of when the points open or the electronic module turns off. This relates to when the spark plug fires in each cylinder.

Cylinder — When the actual firing order is used, this relates to the actual cylinder number. When the actual firing order is not used this relates to the Nth cylinder in the firing order.

Dwell — The individual Dwell of each cylinder during one revolution of the distributor.

Secondary Ignition Diagnostic Conventional Ignition



Figure 2-30

The KV test samples a series of firings for each cylinder, then reports on individual spark plug burn times (milliseconds) and the following KV readings:

“Average KV” — The average KV required to initiate a spark. The amount for each cylinder’s secondary circuit is stored and shown on the screen in the proper cylinder column.

“Delta KV” — The difference between the minimum and maximum KV.

“Burn Time” — The length of time in milliseconds that the spark plug is arcing.

“Burn KV” — The average KV required to maintain the spark. The amount for each cylinder’s secondary circuit is stored and shown on the screen in the proper cylinder column.

“Burn KV Slope” — The change in Burn KV from the start of the spark line to the end of the spark line.

“Coil Oscillations” — The average number of secondary coil oscillations per cylinder.

After delta KV is displayed, the operator will be prompted to snap the throttle wide open and release it. This action is needed to obtain Snap KV and Circuit Gap values.

“Snap KV” — Secondary KV for each cylinder is sampled under load caused by engine acceleration. The highest value is stored and shown on the screen.

“Circuit Gap KV” — The voltage required to jump the largest air gap (except spark plug gap) in each cylinder secondary circuit is stored and shown on the screen.

Repeating this test may yield slightly different values. This is due to variations in mixture richness, turbulence, temperature, etc.

1. Start the engine. The analyzer samples the cylinder firings and calculates the test values.
2. Follow the screen prompt and “snap” the throttle. The analyzer measures the burn time, various KV readings and circuit gap, and then displays the results for each cylinder on the chart on the screen.

Press:

- [F2] — to access diagnostic messages;
- [F3] — to display the *Secondary Live* screen;
- [F4] — to cancel the test while it is running, or repeat the test after it has completed.

Secondary Live Screen

If you press [F3] the *Secondary Live* screen will appear (see Figure 2-31).

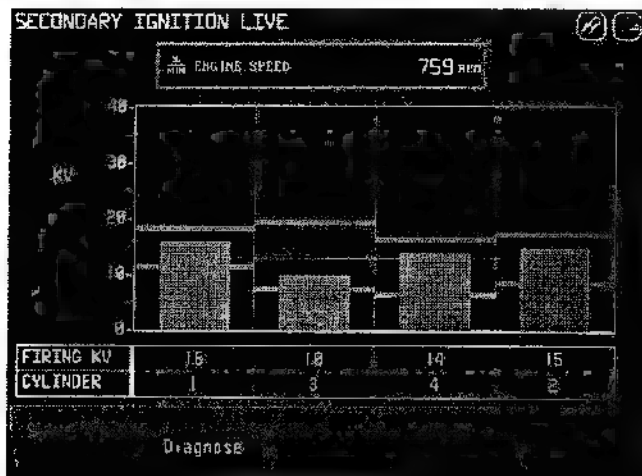


Figure 2-31

Gray bars represent the minimum and maximum KV's detected. The thin white line represents the average KV's detected.

Press:

- [F2] — to run the diagnostic procedure;
- [F9] — to reset the Min. and Max. bars.

Digital Secondary KV - DIS

The test for DIS vehicles runs the same way as conventional tests. Follow the screen prompt and "snap" the accelerator when prompted.

Secondary data is collected from the DIS system. After a few seconds, the display screen reports the following KV readings for the compression firings and exhaust firings of each cylinder (see Figure 2-32).

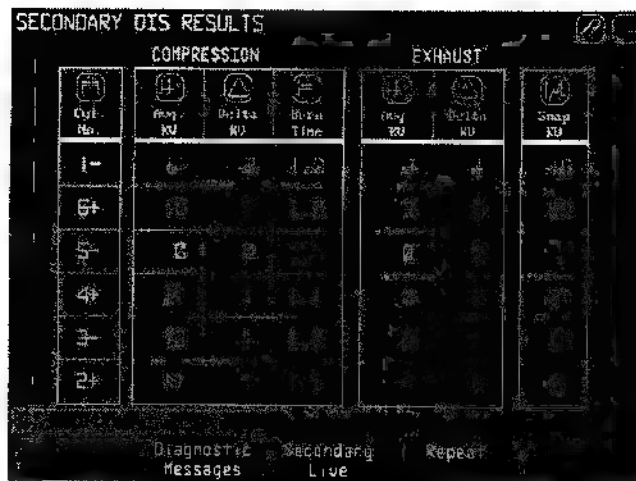


Figure 2-32

"Average KV" — The average KV required to initiate spark, averaged over a number of firings.

"Delta KV" — The difference between the minimum and maximum KV.

"Burn Time" — The length of time in milliseconds that the spark plug is arcing.

NOTE The "Average KV" values for compression should be several KV higher than the "Average KV" for exhaust. Compression increases cylinder resistance thus requiring higher voltage at the plug. High "Average KV" values for exhaust indicate high resistance.

Again, repeating this test may yield slightly different values, due to variations in mixture richness, turbulence, temperature, etc.

DIS Secondary Live Screen

If you press [F3] the *DIS Compression Live* screen will appear (see Figure 2-33).

Gray bars represent the minimum and maximum KVs detected. The thin white line represents the average KVs detected.



Figure 2-33

Press:

- [F2] – to run the diagnostic procedure;
- [F3] – to toggle between DIS Exhaust and Compression, (note that the screen title will change) displays exhaust firings;
- [F4] – to display all positive firings;
- [F5] – to display all negative firings.

Timing Test Diagnostic

The Timing Diagnostic tests are Total Advance, Centrifugal Advance, and Base Timing. Measured results are compared against the vehicle specification entered and then are highlighted on the *Results* screen to indicate the condition and generate diagnostics.

The sequence described below describes the timing test for a vehicle equipped with a "Standard Distributor" - one equipped with centrifugal weights and a vacuum advance unit. The timing test will change depending on the vehicle specification entered. For example, vehicles with computer-controlled timing will not perform the centrifugal advance portion of the test.



Make sure the vehicle cannot roll! Place the transmission in PARK or NEUTRAL. If necessary, chock the wheels.

1. The *Timing Test* screen appears (see Figure 2-34). The analyzer will test the Total Advance Timing first.

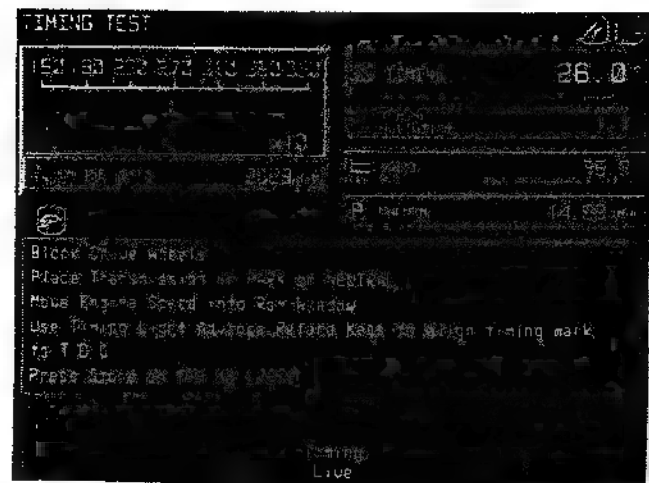


Figure 2-34

2. Start the engine and increase the RPM into the green range shown in the RPM meter.
3. Press [ADVANCE] or [RETARD] on the timing light to align the timing marks on the engine.

NOTE Lightly tap the "Advance" or "Retard" buttons to advance or retard the timing 1/2 degree at a time. When the timing marks line up press [STORE] on the timing light. While maintaining the RPM at the specified level, use the timing light to move the timing mark to Top Dead Center (T.D.C.). Once the mark is at T.D.C. press [STORE].

4. The analyzer will now perform the *Centrifugal Advance* test. Remove the vacuum advance hose from the vacuum unit and plug the hose.
5. Increase the RPM into the green range field. Use the timing light to align the timing mark to T.D.C. Press [STORE] on the timing light.
6. The analyzer will now perform the *Base Timing* test. Follow the instructions on the vehicle's emissions decal and prepare the engine for the *Timing Test*. Use the timing light and set the timing mark according to the decal instructions. Once the timing mark is set correctly, press [STORE] on the timing light.

From the Base Timing screen, press:

- [F2] – to display the *Timing Test Results* screen (see Figure 2-35);
- [F3] – to display the *Timing Live* screen;
- [F4] – to repeat the test.

| | Base Timing | Centrifugal Advance | Total Timing |
|---------------|-------------|---------------------|--------------|
| Engine Speed | 2050 | 2050 | 2050 |
| Timing | 10.0 | 10.0 | 20.0 |
| Specification | 10.0 | 10.0 | |
| Timing | 0.0 | 0.0 | 0.0 |
| Advance | 0.0 | 0.0 | 0.0 |
| Base | 10.0 | | 20.0 |
| Advance | 10.0 | | |

Diagnostic Messages Timing Live Repeat

Figure 2-35

At the *Timing Test Results* screen, press:

- [F2] – to view diagnostic messages;
- [F3] – to go to the *Timing Live* screen;
- [F4] – to repeat the test.

When you are finished, restore the engine to its normal operating condition. For example, if you are testing a Ford equipped with an EEC system, reinstall the in-line spout connector that you removed before starting the test. If you are testing a GM vehicle, re-enable the Electronic Spark Timing Controls and clear codes.

User Tests

Timing Live Screen

Press [F3] for the Timing Live screen (see Figure 2-36). Use this screen to check the effects of any changes you make to the vehicle.

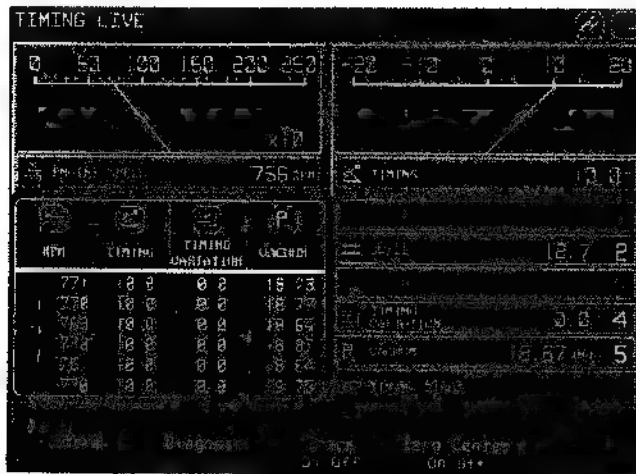


Figure 2-36

Use the Arrow Keys to select either meter as active. Press the number of the digital meter you wish to display in the analog meter box.

Press:

- Left- and Right-Arrow keys** – to select the active meter;
- [F1]** – to store the current reading in analyzer memory (data will be displayed in the boxes at the lower left corner of the screen);
- [F3]** – to turn meter trace (used to show trends) "ON" and "OFF;"
- [F4]** – to zero-center the active meter.

Select *User Tests* from the *Diagnostic Tools* menu. The *User Tests* menu will appear (see Figure 2-37).

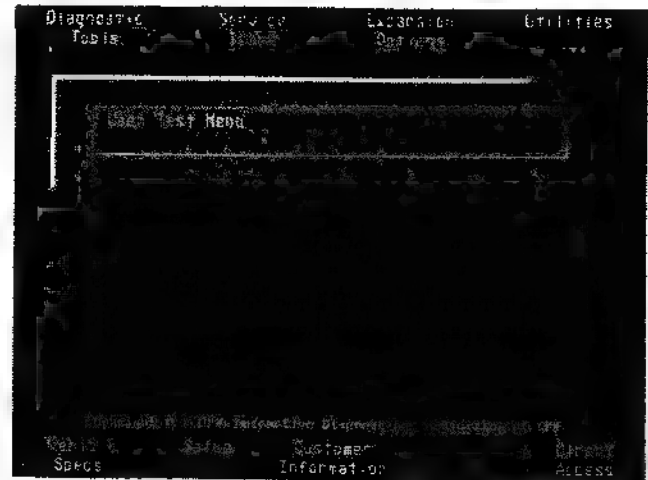


Figure 2-37

This menu, which you create, can contain up to ten different custom test sequences. For details on how to create a user test, see Chapter 5, "Utilities."

We recommend that you include Customer Information and Vehicle Specifications as the first and second parts of every user test.

Use the Arrow Keys to scroll up and down the test list or type the number of the test you wish to run. Press [ENTER] to start the test.

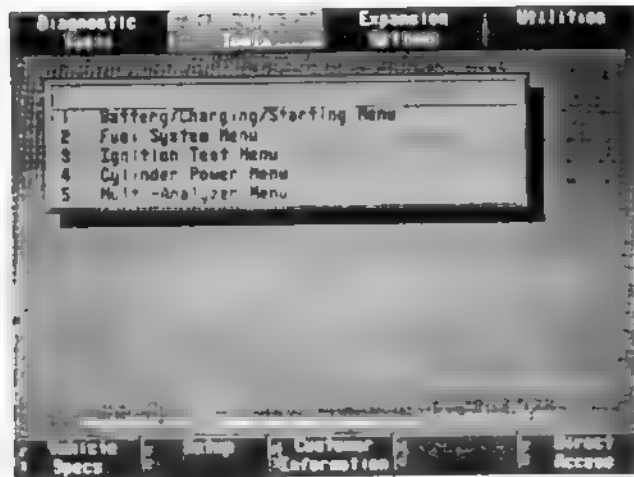
When each sub-routine in your test is completed, press [F10] to proceed to the next sub-routine.

Press [F10] two times quickly to display a menu that will allow you to quit, repeat or skip a test in the routine you are running.

Notes:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Chapter 3 Service Tools



The Service Tools Menu lists menus that contain system-related tests that allow you to test specific vehicle systems.

Many Service Tools Tests begin with a “live” screen allowing you to visually check the system without running the diagnostic routine. The “live” screen allows you to adjust the vehicle and see the effects of changes as you make them.

Battery/Starting/Charging Menu — Contains tests for the electrical system

Fuel System Menu — Provides emission tests for carbureted and fuel-injected vehicles.

Ignition Test Menu — Provides diagnostic tools for checking the primary, secondary and timing systems on a vehicle.

Cylinder Power Menu — Provides cylinder speed and contribution tests.

Multi-Analyzer Menu — Provides multimeters, “Lab” scopes and recording scopes for digital and or analog waveform analysis.

Hot Keys

[F6] - **Help** — Displays help screens.

[F7] - **Trigger Lead Status** — Displays *Trigger Lead Status* screen.

[F8] - **Kill** — Stops the engine.

[F9] - **Clear** — Clears data fields and displays

[F10] - **Previous Menu** — Aborts the test in progress and returns to the previous menu or proceeds to the next test in a user test.

[F11] - **Form Feed** — Form feeds paper from the printer.

[F12] - **Print Reports** — Displays the *Print Reports* menu.

[Print Screen] — Prints a “screen dump” - an exact copy of what appears on the screen.

Main Icons



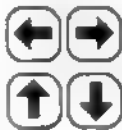
Press [F7] to see Lead Status Screen. Flashing icon indicates problem with one or more leads.



Press [F10] to display previous menu screen.



DIS Specs loaded.



Arrow Keys are active - press the appropriate arrow to scroll up or down a text screen, or change the scale on a meter screen.

Battery / Charging / Starting Menu



Figure 3-1

Battery Test

Overview

This routine is designed to test and report on the condition of any 12-volt automotive battery. The test reports the following data:

- **Available CCA**— (Cold Cranking Amps) from the battery.
- **Open Circuit Voltage** — measured at the battery positive and negative terminals
- **Load Voltage** — measured at the battery positive and negative terminals while a load is placed on the battery.
- **Recovery voltage** — measured at the positive and negative terminals during a period of time after the load is removed from the battery.

Required Lead Hookup:

- Battery Load Leads on battery terminals

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

Test Procedure

1. Highlight *Battery Test* from the *Service Tools* menu and press [ENTER]. Follow the screen prompt and type in the battery CCA rating. If you are not sure of the battery's rating, refer to a battery application manual, or enter the numbers per the chart below.

| No. of Cylinders | CCA |
|------------------|-----|
| 4 | 400 |
| 6 | 500 |
| 8 | 575 |

Type in the CCA rating and press [ENTER]. To change the battery rating units, press [F5]. The *Battery Rating Units* screen will appear. Type the number which matches the rating units you will use. The available units are:

- CCA** — Cold Cranking Amps;
- DIN** — German Institute for Standardization units;
- IEC** — International Electrotechnical Commission units;
- A-HR** — Amp-Hours.

- 2 The test will run and the results screen will appear (see Figure 3-2).

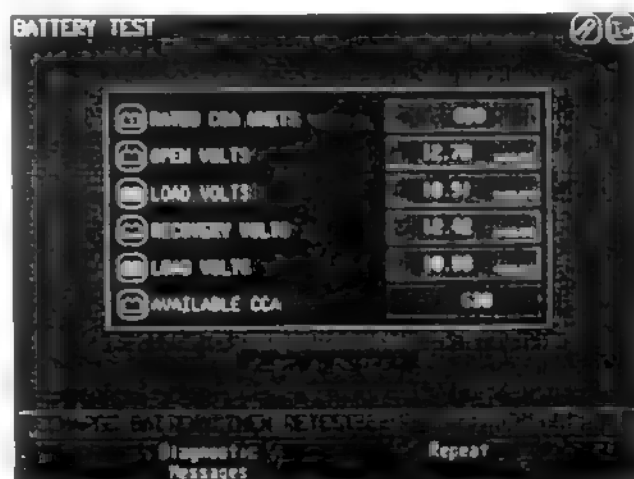


Figure 3-2

Results in green are within specification. Results in yellow are marginal - no diagnostics are available. Results in red are above or below acceptable established limits. Results in white have no diagnostics available because Vehicle Specifications were not entered.

Press:

- [F2] – to display the diagnostic messages;
- [F4] – to run the test again;
- [F10] – to return to the *Service Tools* menu;
- [F12] – to display the *Print Reports* menu.

Charging Test

Overview

The charging test allows you to measure the alternator output under a load condition. This test also provides you the tools necessary to check the diode condition.

Conventional Ignitions

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Amp Probe

Recommended Lead Hookup:

- Complete hookup per Figure 1-27.

Direct Ignition Systems (DIS)

Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Amp Probe
- Low Current Probe (required only if there is an inadequate secondary signal – connect the low current probe to the B+ ignition module.)



Place the transmission in "PARK" or, if manual, "NEUTRAL." Set the parking brake. Make sure the vehicle cannot roll. If necessary, chock the wheels.

Charging Live Screen


The *Charging Live* screen (see Figure 3-3) appears when this test is selected. Use this screen to make sure that all leads and vehicle components are working correctly. If the "AMP" digital meter shows a high or negative reading, zero the amp probe.




Figure 3-3

Press

- [F1] – to zero the amp probe
- [F2] – to run the diagnostic routine
- [F3] – to update the diode pattern which appears on the screen;
- [F4] – to place a load on the battery.
- [F5] – to toggle the scales on the data display between a high and low scale

 The [F2] and [F4] keys are not available until the battery recovers from the load applied to it. When the timer reaches zero the keys will appear

 If it is necessary to zero the amp probe remove the probe from the vehicle and completely close the probe jaws. When the analyzer completes the *Zero Amp Probe* procedure, replace the probe making sure it is clamped around ALL negative battery leads! Check the arrow on the clamp carefully. The probe is clamped correctly around the negative terminal wires when the probe arrow points toward the battery

Diagnostic Test Procedure

- 1 From the "live" screen, press [F2]. Follow the screen prompt and run the engine at 2000 RPM. The green line on the graph represents voltage. The gray line represents alternator amps.

 If the alternator amps are over 20, a timer will appear on the screen. The test may then take up to thirty seconds to complete

The analyzer will then place a load on the battery and then allow the battery to stabilize.

2. Follow the next screen prompt and run the engine at idle. The analyzer will then apply a load to the battery.

The diode pattern will appear on the screen (see Figure 3-4,

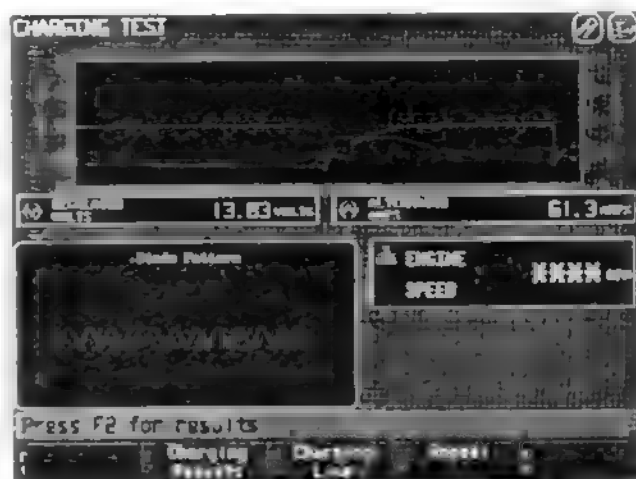


Figure 3-4

Press

- [F2] – to display the *Charging Results* screen.
- [F3] – to display the *Charging Live* screen;
- [F4] – to repeat the test.

Charging Results Screen

When you press [F2] the *Charging Results* screen appears (see Figure 3-5).



Figure 3-5

The gray bars represent the actual readings. The yellow bars on the "Regulator" graph represent marginal readings. For acceptable results, the gray bar should appear well inside the green area on both graphs. The digital readings shown below the graphs will also indicate whether the results are acceptable. Readings outside specified limits will appear in red.

The analyzer then prompts you to judge the diode pattern. Refer to Figure 3-6.

Press:

- [F1] – to indicate the diode pattern is good;
- [F3] – to indicate the diode pattern is bad;
- [F5] – to indicate the diode pattern is flat.

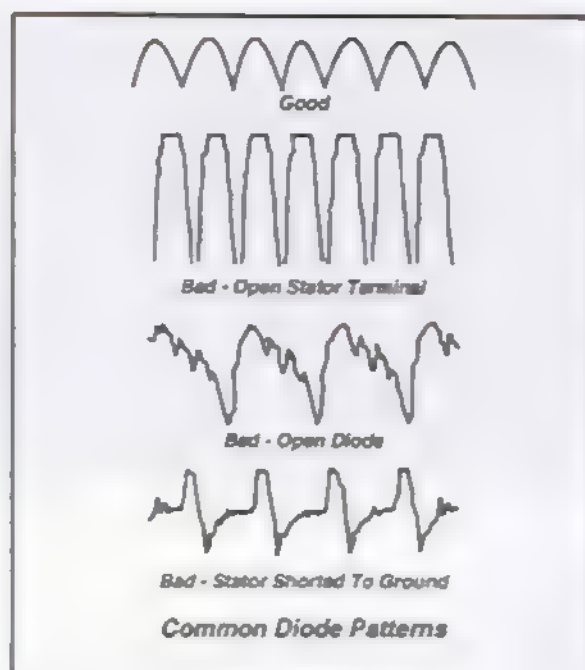


Figure 3-6

A good pattern will show regular, even waves, with some variation acceptable. A bad pattern has uneven or irregularly shaped waves. A flat pattern indicates the alternator is not working at all.

After you indicate the pattern condition, press:

- [F2] – to display the diagnostic messages;
- [F10] – to return to the *Service Tools* menu;
- [F12] – to print the test report.

Cranking Test

Conventional Ignitions



Place the transmission in "PARK" or, if manual, "NEUTRAL." Set the parking brake. Make sure the vehicle cannot roll. If necessary, chock the wheels.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Amp Probe

Recommended Lead Hookup:

- Connect all leads per Figure 1-27

Cranking Live Screen

The *Cranking Live* screen appears (see Figure 3-7) when the test is selected. Use this screen to make sure that all leads and vehicle components are working correctly. If the "AMP" digital meter shows a high or negative reading, zero the amp probe.

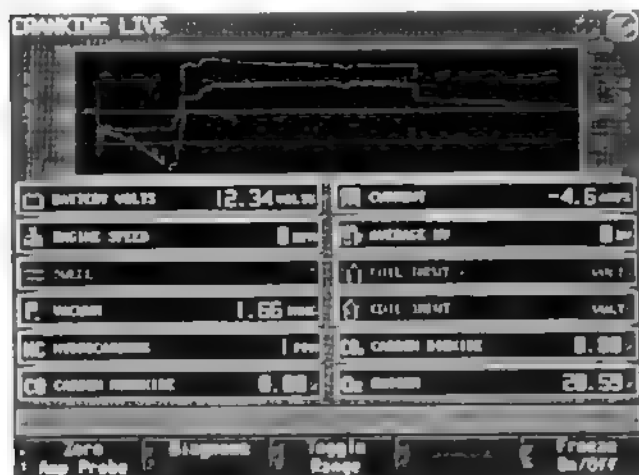


Figure 3-7

Press

- [F1] – to zero the amp probe;
- [F2] – to run the diagnostic routine;
- [F3] – to toggle the ranges of the data displayed between high and low scales
- [F4] – default is to "ON", which "kills" the ignition system (conventional ignitions only), press to remove inhibit and allow engine to start;
- [F5] – to freeze screen information.

Diagnostic Procedure

1. If the engine is running when you press [F2], the analyzer will kill the engine. Follow the screen prompt (see Figure 3-8) and crank the engine until it starts.



Figure 3-8

Press

- [F2] – to display Diagnostic Messages, after the engine starts;
- [F3] – to display the *Cranking Live* screen
- [F4] – to repeat the test

Direct Ignition Systems (DIS)



Place transmission in "PARK" or, if manual, "NEUTRAL." Set parking brake. Make sure vehicle cannot roll. If necessary, chock the wheels.

Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Low Current Probe
- Amp Probe

Follow the screen prompt and disable the fuel system as described below. Then crank the engine until it starts and press [F2] to access Diagnostics.

PFI (Ported Fuel Injection) Vehicles:

1. Turn the ignition key "ON."
2. After the ignition key is "ON," press the accelerator pedal all the way down. This will cause the computer on these vehicles to inhibit fuel flow because it is put in a "Clear Flood" mode.
3. Hold the accelerator pedal all the way down and crank the engine until the prompt "ENABLE FUEL SYSTEM - START ENGINE" appears. The analyzer then displays the results on the screen. Release the accelerator pedal and continue cranking to allow the engine to start.



If the engine starts before the "Re-enable Fuel" prompt appears, release the accelerator pedal, turn the ignition "OFF" and repeat the test.

For GMTBI (Throttle Body Injection) Vehicles:

1. Remove the injector cable at the injector. These vehicles are not automatically disabled when the throttle is wide open. Remove the rubber or plastic airflow filter over the injector, and then unplug the cable connector at the injector.
2. Crank the engine until prompted to re-enable the fuel system. When the test results appear on the screen, stop cranking.
3. Follow the screen prompt and re-connect the injector and start the engine.

For Ford, Chrysler / Mitsubishi, and Other Systems:

1. Disable the fuel system. Check the manufacturer's specifications for the correct procedure.
2. Crank the engine until prompted to enable the fuel system. Discontinue cranking when results appear on screen. Re-enable the fuel system, and start the engine.

Ported Fuel Injection (PFI) with Clear Flood Mode, and Sequential Fuel Injection (SEFI) with Clear Flood Mode

1. Turn the ignition key to the RUN Position.
2. Depress the Accelerator all the way to WIDE OPEN THROTTLE.
3. Begin cranking the engine until prompted to enable fuel system.
4. Release the Accelerator and continue cranking until the engine starts.



If the engine starts during Step 3, immediately release the accelerator pedal and re-run the test.

Ported Fuel Injection (PFI) without Clear Flood Mode, and Sequential Fuel Injection (SEFI) without Clear Flood Mode

1. Disconnect Fuel Pump Relay or Inertia Switch.
2. Run the engine until all fuel is exhausted from the fuel system.
3. Follow the screen prompts

Throttle Body Injection (TBI) and Central Fuel Injection (CFI)

1. Disconnect the fuel injector connector(s) at the fuel injector.
2. Run the engine until all fuel is exhausted from the fuel system
3. Follow the screen prompts

Disabling Fuel Systems - Carburetor Carburetor with Electric Fuel Pump

1. Disconnect the carburetor fuel line to the fuel pump.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts

Carburetor with Mechanical Fuel Pump

1. Carburetor fuel shut-off with fuel pump.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts

Carburetor with Decel Valve

1. Disconnect decel valve per manufacturer's recommendations.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts.

Drain Test

Use the Drain Test to determine the current drain cause by any vehicle component. Use the Low Current Probe to detect a current drain. For best results, do not connect the Low Current Probe around the battery leads.

Required Leads:

- System Ground (White)
- Low Current Probe

Test Procedure

1. Select the test from the menu. The *Drain Test* screen appears (see Figure 3-9).



Figure 3-9

Fuel System Menu

2. Press [F1] and follow the screen prompts to zero the Low Current Probe.

3. Set up the test.

Press:

The arrow keys – to change the audible alarm level.

[F1] – to zero the Low current probe;

[F3] – to toggle the meter scale on the display screen between 0-1 amp and 0-10 amps;

[F5] – to freeze the meter display, so that you can study the pattern more closely.

4. Clamp the Low Current Probe around the wire in the circuit that you want to test. Make sure that the probe is completely closed.
5. Make sure the remote is nearby. Press the Up or Down Arrow Keys to set the audible alarm limits. The light gray line in the meter on the display screen will move up or down as you press the Arrow Keys.
6. The meter displays amps over time. As the analyzer detects a current drain, it will draw the pattern on the screen. If the drain moves above the alarm level which you have set, the remote will beep.

NOTE

For most accurate results, zero the amp probe often during extended testing.

Menu Choices

Selecting the *Fuel System* menu allows you to display a menu of two tests. The *Four Gas Exhaust Test* displays exhaust gas readings for the vehicle at both idle and cruise RPM.

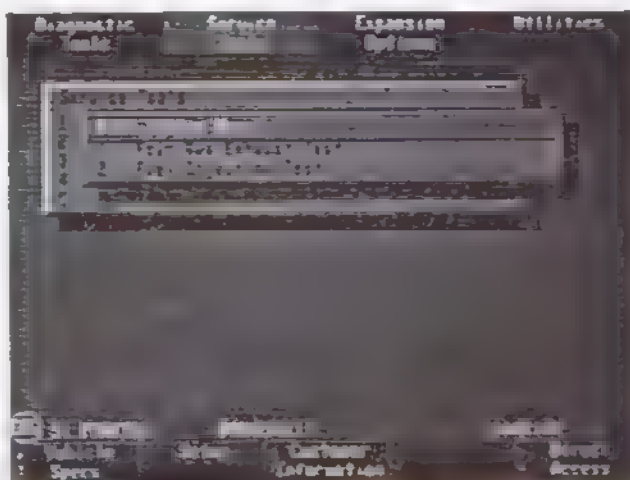


Figure 3-10

The *Fuel Injection Test* displays exhaust gas readings as well as electrical and fuel pressure data for fuel injected systems.

Four Gas Exhaust Test

Conventional Ignitions

Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Secondary Lead and Adapter
- Exhaust Probe

Recommended Lead Hookup:

- Connect all leads per Figure 1-27

Direct Ignition Systems:

Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Low Current Probe
- Amp Probe
- Exhaust Probe

Live Screen

The "live" screen (see Figure 3-11) will appear whenever the test is selected. The default analog meters (RPM and Vacuum) will always appear. Use the arrow keys to highlight either meter. Press the number of any highlighted digital meter to display that meter in the highlighted meter. Digital meters colored in gray are not available either because the leads are not connected or they are already displayed. Digital meters will be gray during bench warm-ups.

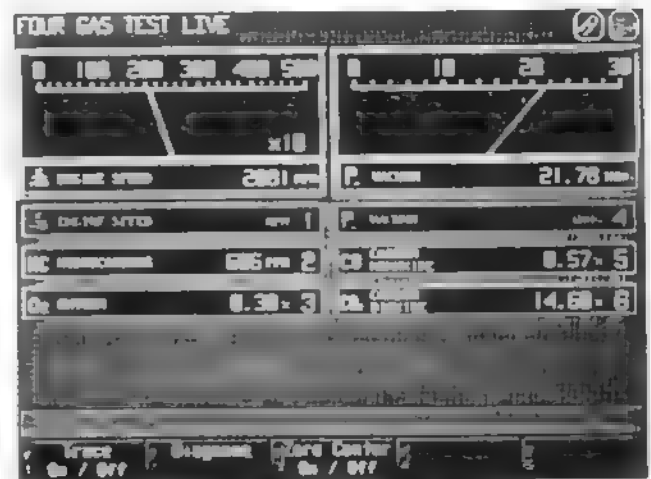


Figure 3-11

Press:

- [F1] – to turn the trace function "ON" or "OFF."
- [F2] – to run the diagnostic test;
- [F3] – to toggle meter zero center function "ON" or "OFF."

Diagnostic Procedure

1. Start the engine, if necessary. Follow the screen prompts and run the engine at cruise RPM. Watch the RPM box - red numbers indicate the RPM is too high, or too low. Green numbers indicate that the readings are within the test limits. When the analyzer detects a stable cruise RPM, the high speed portion of the test will run.
2. Follow the screen prompt and adjust the vehicle's engine to run at the manufacturer's idle RPM. When the analyzer detects the RPM within spec, the analyzer will read the RPM and dilution values, and will display the results on the screen, with a shadow function to show the acceptable range (see Figure 3-12).

Press:

- [F2] – to display diagnostics;
- [F3] – to display the *Live* screen;
- [F4] – to repeat the test.

The Engine Speed Meter on the left side will always be displayed.

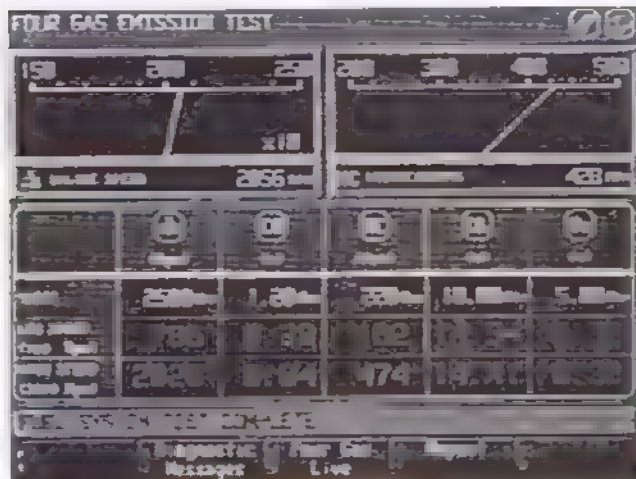


Figure 3-12

Fuel Injection Test

Use this test to diagnose problems with injector pulse, fuel pressure and related intake manifold vacuum problems in fuel injection systems.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Vacuum/Pressure Transducer
- Low Current Probe around the #1 cylinder injector wires.

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

Test Procedure



COVER ALL FUEL SYSTEM TEST LEAD CONNECTIONS WITH A RAG TO PREVENT FUEL FROM SPRAYING OVER THE HOT ENGINE. WHEN BLEEDING THE SYSTEM, DRAIN THE BLEED FUEL INTO A PROPER CONTAINER.

1. Install a drain hose on the end of the bleed adapter. Refer to Figure 3-13. Make sure the hose is long enough to reach a container to catch the excess fuel drained when you bleed the system.
2. Connect the Vacuum/Pressure Transducer to the fuel injection system (see Figure 3-13). Position the transducer so that it is lower than the connection at the fuel rail. Bleed all air from the transducer. Connect the proper adapter to the fuel line between the TBI unit and the fuel pump. In other systems, connect the adapter to the fuel rail, again, using the proper adapter. Adapter kits are available from various manufacturers.

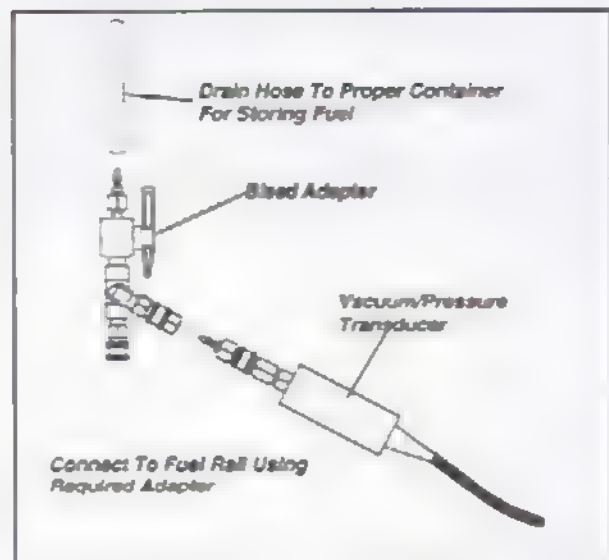


Figure 3-13

To read fuel pressure only, connect the vacuum transducer directly to the adapter.

To read fuel pressure changes (Delta Pressure), connect the bleed adapter to the fuel system adapter first. Connect the transducer to the bleed adapter so that the transducer is at the low point. This allows air to rise up out of the system.

Connect the low current probe to the #1 cylinder injector wires. This allows you to relate the #1 injector electrical pulses to the fuel pressure pulses shown on the screen.

3. Start the engine. Select the *Fuel Injection Test* from the *Fuel System* menu. The *Fuel Injection Test* screen appears (see Figure 3-14).

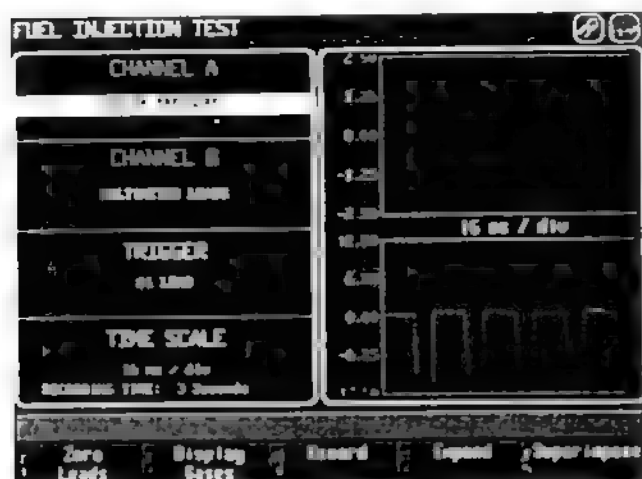


Figure 3-14

Press:

- [F1] – to zero all leads used in this test.
- [F2] – to display the analysis screen (see Figure 3-15).
- [F3] – to record patterns.
- [F4] – to expand the scope meters to full screen.
- [F5] – to superimpose both patterns in one meter screen.

4. The cursor will appear in the trigger box. Press [ENTER]. The trigger menu will pop out. Use the Arrow Keys to select a trigger and press [ENTER].

The pop-out menu will disappear. Press the up or down arrow key to move the cursor to the next block. Select the correct channels and time scales as needed.

Look at the patterns which appear in the meters. If the fuel pressure pattern looks smooth or appears as a nearly straight line, bleed the air out of the fuel system. Drain any excess fuel into a proper container. Repeat the procedure until fuel pressure pattern looks well-defined, as shown in Figure 3-14.

5. Figure 3-15 shows the analysis screen.



Figure 3-15

From the *Analysis* screen, press:

- [F1] — to zero all leads used in this test;
- [F2] — to display the *Adjustments* screen;
- [F3] — to record patterns;
- [F4] — to expand the scope meters to full screen;
- [F5] — to superimpose both patterns in one meter screen.

Figure 3-16 shows an example of the *Expanded* screen.



Figure 3-16

Press:

- [F2] — to return to the adjustments screen;
- [F3] — to freeze the display;
- [F5] — to superimpose both patterns in one meter screen.

Figure 3-17 shows an example of the *Freeze* screen. Press [F3] to unfreeze the display.

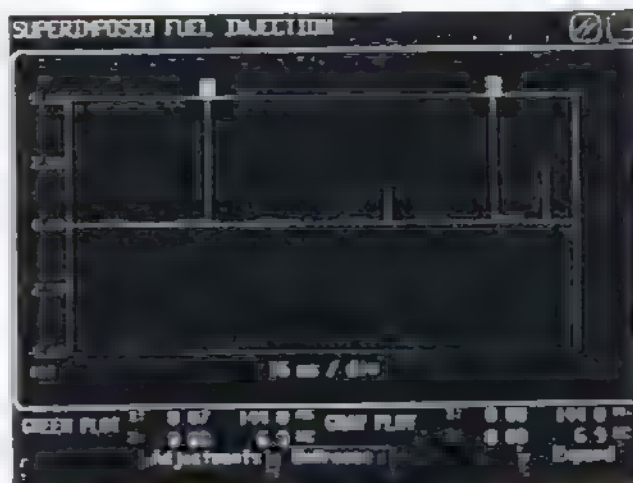


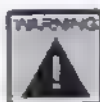
Figure 3-17

Moving flags

Type the number of the flag to move. The number on the flag on the screen will grow larger to show that it is activated. Press the right- or left-arrow keys to move the flag from side to side. Note that the digital readouts under the meters will change as the flag moves. Flags move in the same manner in both expanded and superimposed modes.

Note the digital displays in the lower right corner of the screen, under the scope display. The readouts display the voltage, time in milliseconds and frequency in hertz at each test point marked by a flag.

6. To complete the test, turn the engine OFF. Cover the transducer assembly with a rag to catch any fuel spillage and remove the assembly from the fuel line.



NEVER ATTEMPT TO REMOVE THE TRANSDUCER ASSEMBLY FROM THE ENGINE WHILE IT IS RUNNING!

Reassemble the fuel line system.

Ignition Test Menu

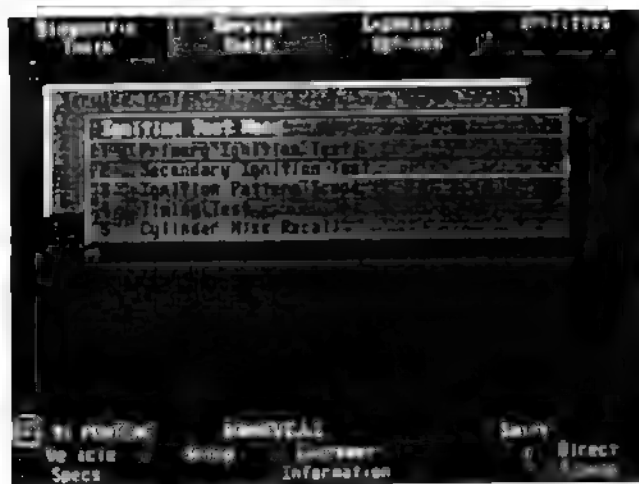


Figure 3-18

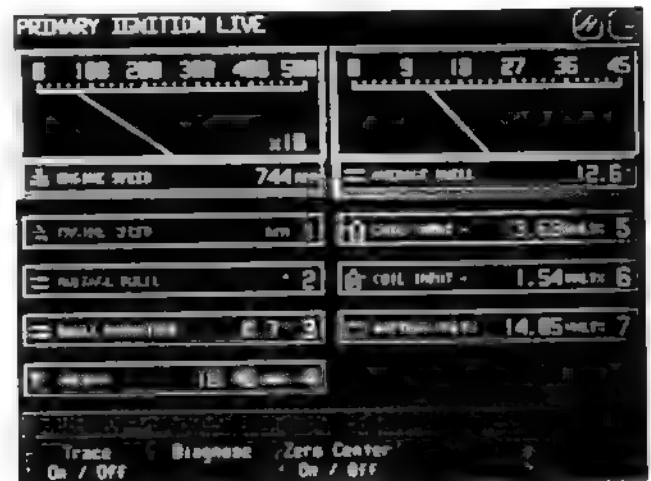


Figure 3-19

Primary Ignition Test

The *Primary Ignition Live* test collects primary ignition data at idle speed.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White,
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

Press

- [F1] – to turn meter trace (used to show trends) "On" or "Off";
- [F2] – to display primary ignition diagnostic information; after data is collected, the results screens are displayed;
- [F3] – to zero center the active meter; value changes are displayed as +/- either side of the zeroed reference point.

Diagnostic Procedure

The test automatically runs once it is selected. The screen shown in Figure 3-20 appears.

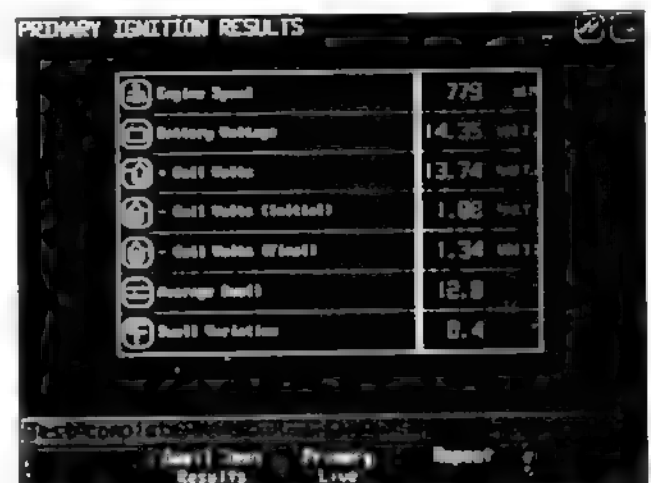


Figure 3-20

Press

- [F2] – to display the *Dwell Test Results* screen,
- [F3] – to display the *Primary Live* screen;
- [F4] – to repeat the test



Figure 3-21

From the *Dwell Test Results* screen (see Figure 3-21), press:

- [F1] — to backup and review the *Primary Ignition Results* screen;
- [F2] — to read the *Diagnostic Messages*;
- [F3] — to display the *Primary Ignition Live* screen;
- [F4] — to repeat the test.

Test Result Definitions

Battery Volts — The voltage measured at the battery positive and negative terminals.

Coil Input + — The voltage measured at the positive terminal of the ignition coil. This measurement is an average of several readings prior to the "Points Open / Transistor Off" portion of the primary pattern.

- Coil Volts — The voltage measured at the negative terminal of the ignition coil. This measurement is an average of several readings just after the "Points Close / Transistor On" portion of the primary pattern.

- Coil Volts (Final) — The voltage measured at the negative terminal of the ignition coil. This measurement is an average of several readings just before the points open / transistor off portion of the primary pattern.

Average Dwell — The average of each cylinders dwell over one distributor revolution. DWELL is the period of time measured in degrees or percent that current is flowing in the primary ignition circuit.

Dwell Variation — The *Maximum Cylinder Dwell* and *Minimum Cylinder Dwell* during one distributor revolution.

Dwell Test Result Definitions

Average Dwell — The average of each cylinder's dwell over one distributor revolution. DWELL is the period of time measured in degrees or percent that current is flowing in the primary ignition circuit

Dwell Variation — The *Maximum Cylinder Dwell* and *Minimum Cylinder Dwell* during one distributor revolution

Dwell On Variation — The variation in degrees or percent of the DWELL ON signal. This measurement relates to variations of when the points close or the electronic module turns on to provide power to the ignition coil.

Dwell Off Variation — The variation in degrees or percent of the DWELL OFF signal. This measurement relates to variations of when the points open or the electronic module turns off. This relates to when the spark plug fires in each cylinder.

Cylinder — When the actual firing order is used this relates to the actual cylinder number. When the actual firing order is not used this relates to the *Nth* cylinder in the firing order

Dwell — The individual dwell of each cylinder during one revolution of the distributor

Secondary Ignition Test

The *Secondary Ignition* test collects and displays KV readings for each cylinder and then reports individual spark plug burn times (milliseconds) and the KV readings listed below

Required Lead Hookup:

- Green #1 Lead
- Conventional Secondary Lead
- System Ground Lead (White)

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

Secondary Live Screen

The *Secondary Ignition Live* screen appears when the test is selected (see Figure 3-22).

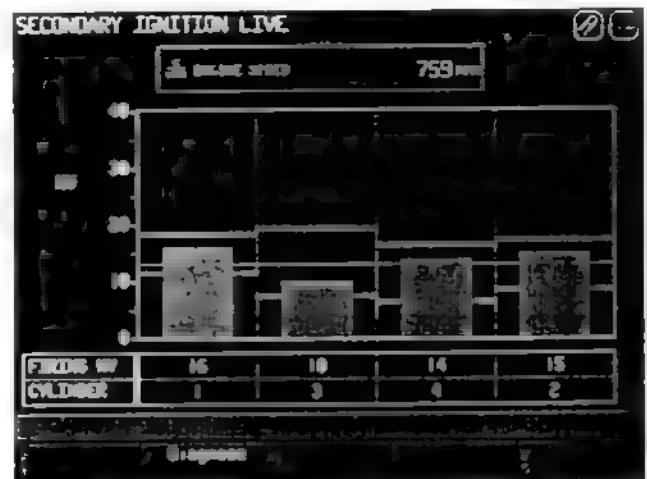


Figure 3-22

Gray bars represent the minimum and maximum KV's detected. The thin white line represents the average KV's detected. Press [F2] to run the diagnostic procedure

Diagnostic Procedure

1. Start the engine. The analyzer samples the cylinder firings and calculates the test values.
2. Follow the screen prompt (run the engine at idle or cranking speeds) and "snap" the accelerator when prompted. The analyzer measures the burn time, various KV readings and circuit gap, and then displays the results for each cylinder on the chart on the screen shown in Figure 3-23.

Press:

- [F2] — to display diagnostic messages;
- [F3] — to display the *Secondary Live* screen;
- [F4] — to cancel the test while it is running, or to repeat the test after it has completed.

Conventional Ignition

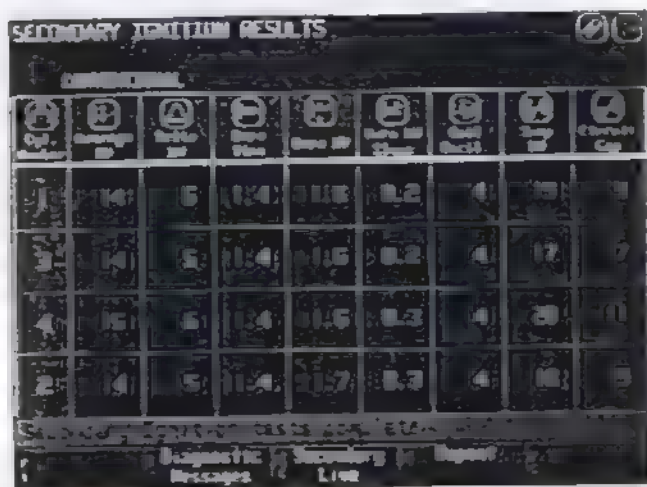


Figure 3-23

KV Readings

Average KV — The average KV required to initiate a spark. The amount for each cylinder's secondary circuit is stored and shown on the screen in the proper cylinder column.

Delta KV — The difference between the minimum and maximum KV.

Burn Time — The length of time in milliseconds that the spark plug is arcing.

Burn KV — The average KV required to maintain the spark. The amount for each cylinder's secondary circuit is stored and shown on the screen in the proper cylinder column.

Burn KV Slope — The change in Burn KV from the start of the spark line to the end of the spark line.

Coil Oscillations — The average number of secondary coil oscillations per cylinder.

After delta KV is displayed, the operator will be prompted to snap the throttle wide open and release it. This action is needed to obtain Snap KV and Circuit Gap values.

Snap KV — Secondary KV for each cylinder is sampled under load caused by engine acceleration. The highest value is stored and shown on the screen.

Circuit Gap KV — The voltage required to jump the largest air gap (except spark plug gap) in each cylinder secondary circuit is stored and shown on the screen.

Repeating this test may yield slightly different values. This is due to variations in mixture richness, turbulence, temperature, etc.

Digital Secondary KV - DIS

The test for DIS vehicles runs the same way as conventional tests

Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Low Current Probe
- Amp Probe

DIS Secondary Live Screen

The *Secondary Ignition Live* screen appears when the test is selected (see Figure 3-24).

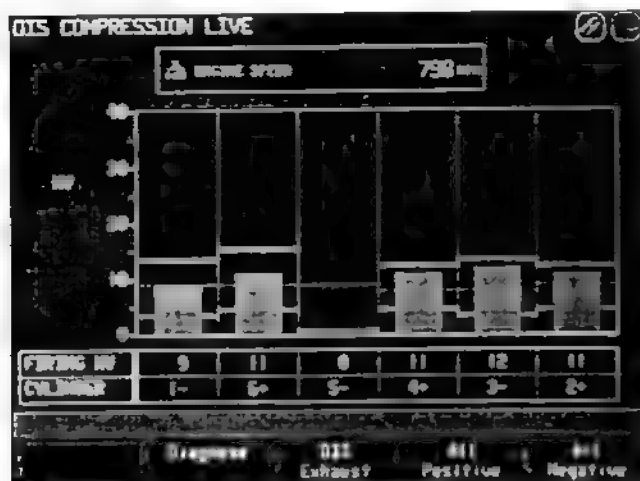


Figure 3-24

Gray bars represent the minimum and maximum KVs detected. The thin white line represents the average KVs detected

Press:

- [F2] – to run the diagnostic procedure;
- [F3] – to toggle between *DIS Exhaust* and *Compression*, (note that the screen title will change) displays exhaust firings.
- [F4] – to display all positive firings,
- [F5] – to display all negative firings.

Diagnostic Procedure

1. Start the engine. The analyzer samples the cylinder firings and calculates the test values.
2. Follow the screen prompt (run the engine at idle or cranking speeds) and "snap" the throttle. The analyzer measures the burn time, various KV readings and circuit gap, and then displays the results for each cylinder on the chart on the screen shown in Figure 3-25.

Press:

- [F2] – to display diagnostic messages;
- [F3] – to display the *Secondary Live* screen;
- [F4] – to repeat the test.

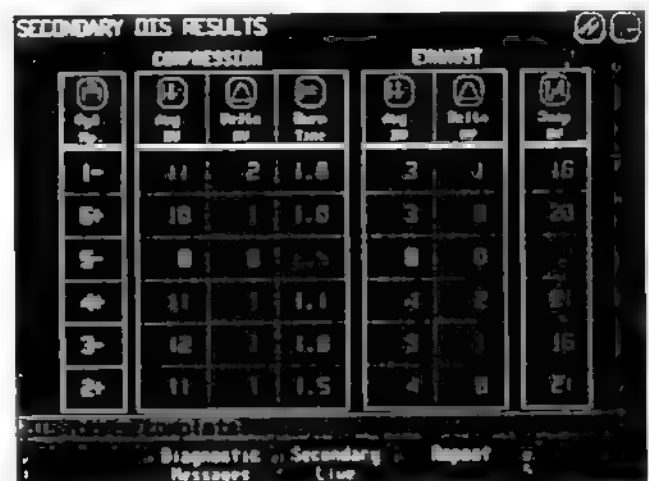


Figure 3-25

Secondary data is collected from the DIS system. After a few seconds, the display screen reports the following KV readings for the Compression Firings and Exhaust Firings of each cylinder (see Figure 3-25):

"Average KV" — The average KV required to initiate spark, averaged over a number of firings.

"Delta KV" — The difference between the minimum and maximum KV.

"Burn Time" — The length of time in milliseconds that the spark plug is arcing.

"Snap KV" — Secondary KV for each cylinder is sampled under load caused by engine acceleration. The highest value is stored and shown on the screen.

NOTE The "Average KV" values for compression should be several KV higher than the "Average KV" for exhaust. Compression increases cylinder resistance thus requiring higher voltage at the plug. High "Average KV" values for exhaust indicate high resistance.

Again, repeating this test may yield slightly different values, due to variations in mixture richness, turbulence, temperature, etc.

Ignition Pattern Scope

Parade Pattern

The parade pattern shows KV peaks of all active cylinders. The default ignition pattern is *Parade Secondary* (see Figure 3-26).



Figure 3-26

Required Analyzer Hookup:

- Green #1 Lead
- Conventional Secondary Lead
- System Ground Lead (White)
- Exhaust Analyzer Probe

Recommended Analyzer Hookup:

- Complete hookup per Figure 1-27.

Press:

Up- and Down-Arrow Keys — to adjust the KV range on the screen (when the arrows appear).

[F1] — to toggle between Parade Primary and Secondary patterns;

[F2] — to toggle between Raster Primary and Secondary patterns;

[F3] — to toggle between Sequential Primary and Secondary patterns;

[F5] — to "freeze" or "un-freeze" the display;

DIS Vehicles

Parade patterns show the compression pattern for all cylinders (see Figure 3-27). Press [F1] to display either all negative or all positive firings. This will enable you to view compression and exhaust firings for all cylinders.

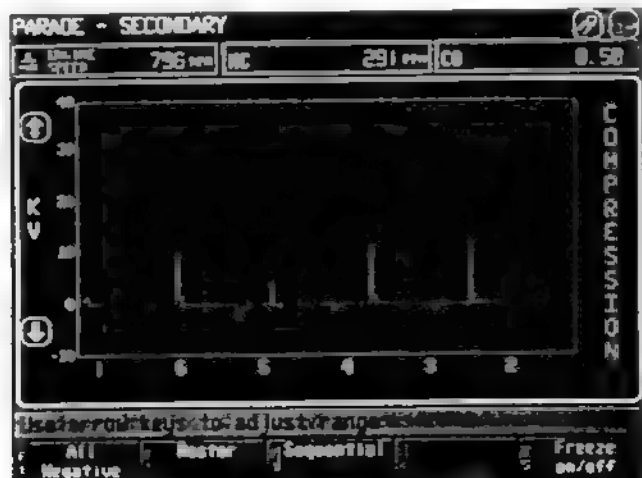


Figure 3-27

Required Analyzer Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Secondary DIS Leads
- Exhaust Analyzer Probe

Recommended Analyzer Hookup:

- Complete hookup per Figure 1-27

Press

Up- and Down-Arrow Keys – to adjust the KV range on the screen (when the arrows appear)

Right- and Left-Arrow Keys – to adjust the time scale on the pattern meter

[F1] – to toggle between “All Negative” cylinder firings and “All Positive” cylinder firings

- [F2] – to display the *Raster Pattern* screen.
- [F3] – to display the *Sequential Pattern* screen.
- [F4] – to return to the *Compression* display after “All Positive” or “All Negative” cylinders were displayed;
- [F5] – to “freeze” or “un-freeze” the display.

Raster Patterns

Raster patterns display the waveforms for all cylinders at one time (see Figure 3-28). The patterns are arranged in firing order from top to bottom.

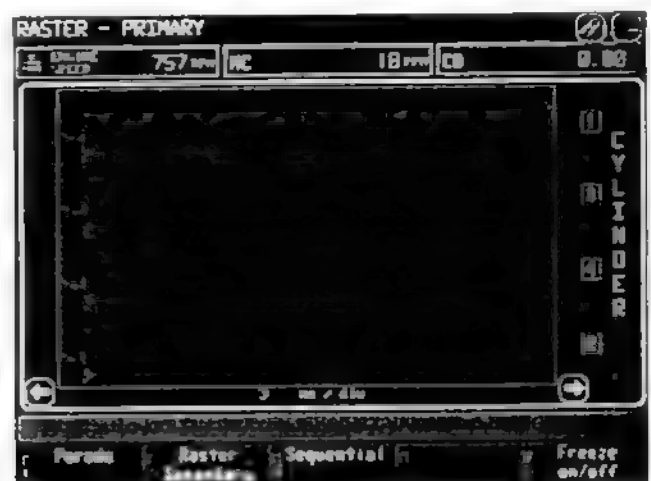


Figure 3-28

Press

Right- or Left-Arrow Keys – to adjust the time scale on the pattern meter.

- [F1] – to display the *Parade Pattern* screen
- [F2] – to toggle between the *Primary* and *Raster Secondary* screens
- [F3] – to display the *Sequential Pattern* screen
- [F5] – to freeze or un-freeze the display

Sequential Pattern

Sequential patterns (see Figure 3-29) display a waveform for each cylinder, in firing order as entered through the *Setup* function at the *Main Menu*.



Figure 3-29



Figure 3-30

Press:

- Up- and Down-Arrow Keys** – to adjust the KV range on the screen (when the arrows appear).
- Right- or Left-Arrow Keys** – to adjust the time scale on the pattern meter.
- [F1]** – to toggle between *Primary* and *Secondary Parade* patterns;
- [F2]** – to display the *Raster Pattern* screen;
- [F3]** – to display the *Sequential Pattern* screen (see Figure 3-30);
- [F5]** – to “freeze” or “un-freeze” the display;

Timing Test

Timing Live Screen

The *Timing Live* screen (see Figure 3-31) appears when this test is selected. Use this screen to check the effects of any changes you make to the vehicle.



Figure 3-31

Use the right- or left-arrow keys to select either active meter. Press the number of the digital meter you wish to display in the analog meter box.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Vacuum Pressure Transducer

Recommended Lead Hookup:

- Complete hookup per Figure 1-27.

Press:

- [F1] – to store the current reading in analyzer memory (data will be displayed in the boxes at the lower left corner of the screen);
- [F3] – to turn meter trace (used to show trends) "ON" and "OFF;"
- [F4] – to zero center the active meter.

The *Timing Diagnostic* test tests total advance, centrifugal advance, and base timing. Measured results are compared against the vehicle specification entered and then are highlighted on the *Results* screen to indicate the condition and generate diagnostics

Diagnostic Procedure

The sequence described below describes the timing test for a vehicle equipped with a "Standard Distributor" - one equipped with centrifugal weights and a vacuum advance unit. The timing test will change depending on the vehicle specification entered. For example, vehicles with computer-controlled timing will not perform the vacuum advance portion of the test.



WARNING Make sure the vehicle cannot roll! Place the transmission in PARK or NEUTRAL. If necessary, chock the wheels.

- 1 Press [F2] The *Timing System Test* screen appears (see Figure 3-32). The analyzer will test the Total Advance Timing first

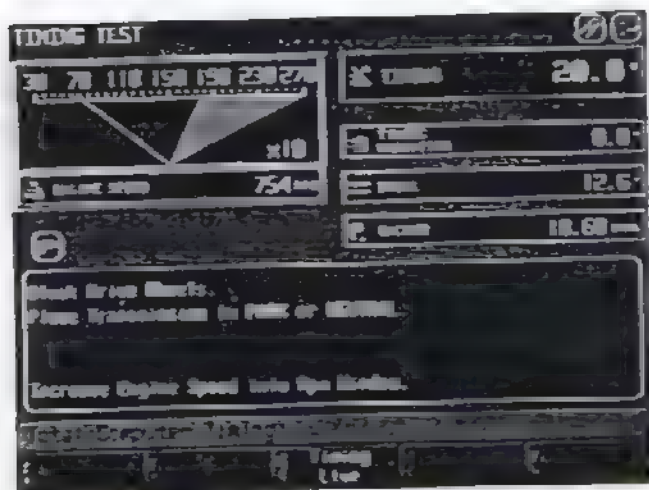


Figure 3-32

2. Start the engine if necessary, and increase the RPM into the green range shown in the RPM meter.
3. Press [ADVANCE] or [RETARD] on the timing light to align the timing marks.

NOTE

Lightly tap the "Advance" or "Retard" buttons to advance or retard the timing 1/2 degree at a time. When the timing marks line up press [STORE] on the timing light. While maintaining the RPM at the specified level, use the timing light to move the timing mark to Top Dead Center (T.D.C.). Once the mark is at T.D.C. press [STORE].

4. The analyzer will now perform the *Centrifugal Advance* test. Remove the vacuum advance hose from the vacuum unit and plug the hose.
5. Increase the RPM into green range field. Use the timing light to align the timing mark to T.D.C. Press [STORE] on the timing light.

6. The analyzer will now perform the *Base Timing* test. Follow the instructions on the vehicle's emissions decal. Use the timing light and set the timing mark according to the decal instructions. Once the timing mark is set correctly, press [STORE] on the timing light.

From the *Base Timing* screen, press:

- [F2] – to display the *Results* screen (see Figure 3-33);
- [F3] – to display the *Timing Live* screen;
- [F4] – to repeat the test.

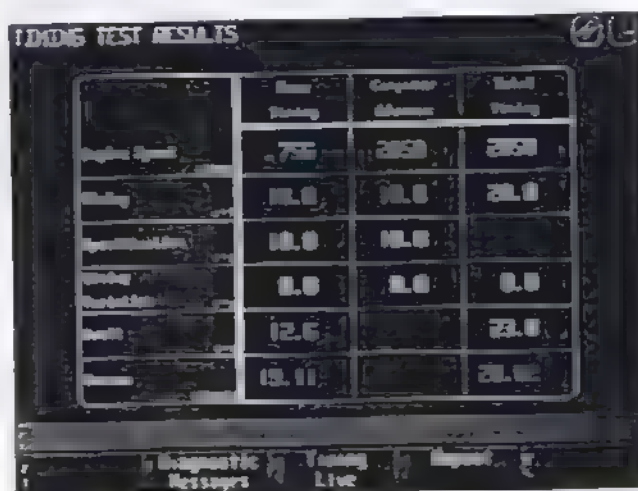


Figure 3-33

Press [F2] to display the diagnostic messages.

When finished, return the engine to its normal operating condition. For example, if you are testing a Ford equipped with an EEC system, reinstall the in-line spout connector that was removed before starting the test. If testing a GM vehicle, re-enable the Electronic Spark Timing Controls and clear codes.

Cylinder Miss Recall

Cylinder Miss Recall helps pinpoint misfiring cylinders by recording the waveforms from each cylinder firing and playing them back for the operator to examine. Make sure that the correct spec is entered for the vehicle so that

- the number of cylinders is entered correctly
- the firing order is entered correctly.
- the analyzer is getting signals from the test leads.

Required Lead Hookup:

- Green #1 Lead
- Conventional Secondary Lead
- System Ground Lead White

Recommended Lead Hookup:

- Complete hookup per Figure 1-27

When the test is selected, the *Cylinder Miss Recall* screen appears (see Figure 3-34)

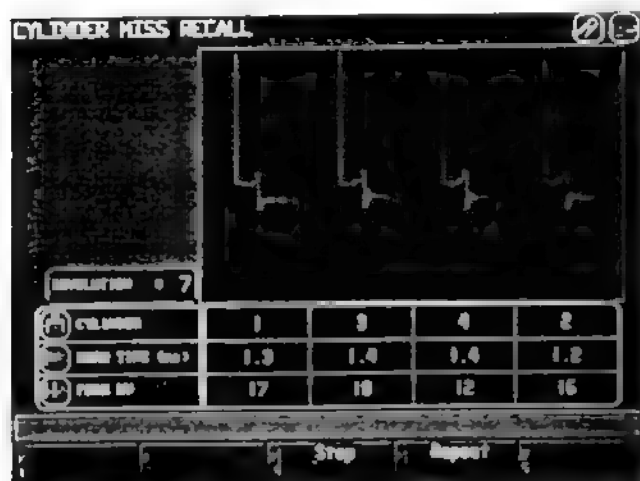


Figure 3-34

As the computer gathers the required information the prompt "COLLECTING IGNITION PATTERNS" appears

Follow the screen prompts and press:

- [F3] – to begin displaying the information on the screen.

The *Cylinder Miss Recall* screen displays the following information for each revolution when playback is stopped by pressing [F3]:

- Revolution number
- Burn time per cylinder, measured in milliseconds
- Peak kilovolts, per cylinder.

The analyzer will play back each revolution recorded until the operator stops the playback.

Press

- [F3] – to stop the playback on a particular revolution.
 [F4] – to repeat the test.

Watch the screen for the miss. When it appears, press [F3] to stop the playback. If you miss the "frame" that shows the misfire, press the up-arrow key to see the next revolution or press the down-arrow key to see the previous revolution. Press [F3] to resume the playback again.

Cylinder Power Menu

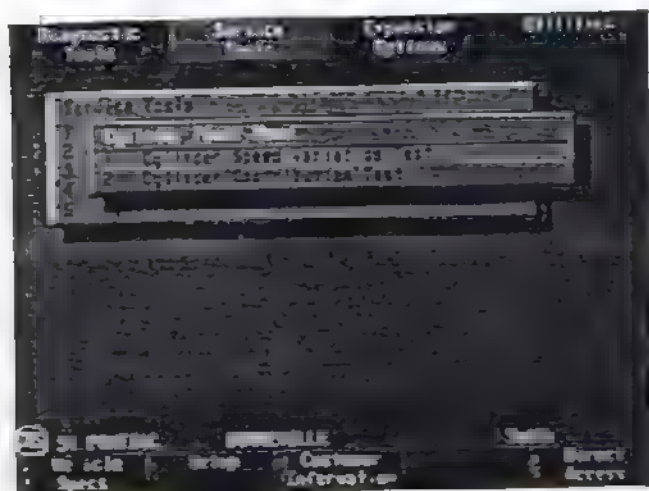


Figure 3-35

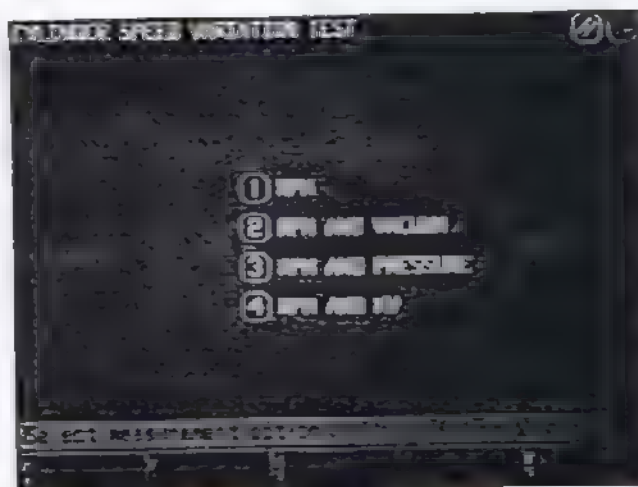


Figure 3-36

Cylinder Speed Variation Test

The *Cylinder Speed Variation Test* plots engine RPM and either average vacuum or pressure over time. The test results are displayed in a window on the screen, and portions of the resulting plot can be magnified for closer inspection.

Required Lead Hookup:

- Green #1 Lead
- Conventional Secondary Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)

Recommended Lead Hookup:

- Complete hookup per Figure 1-27.

1. Select the *Cylinder Speed Variation Test* from the *Cylinder Power* menu. Follow the first screen prompt and press the number which matches the test configuration you wish to run (see Figure 3-36).

2. The *Data Collection* screen appears (see Figure 3-37). Follow the screen prompts and press:

- [F1] – to zero the vacuum/pressure lead, if you are running the RPM and Vacuum or Pressure test;
- [F2] – to run the test under acceleration;
- [F3] – to run the test under deceleration;
- [F4] – to run the test at idle.



Figure 3-37

- Follow the screen prompts and run the engine at the specified RPM. After the analyzer gathers the test data and processes the results, the "Cylinder Speed Variation Test" screen appears (see Figure 3-38).

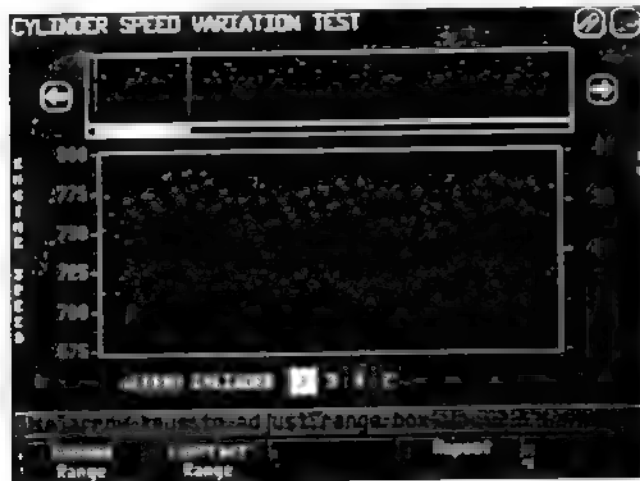


Figure 3-38

Press:

Right- or Left-Arrow Keys – to move the yellow range window right or left.

[F1] – to make the yellow range window in the upper full curve window larger

[F2] – to make the yellow range window in the upper full curve window smaller.

[F4] – to repeat the test.

The Number Key matching the cylinder you want to highlight – The highlighted cylinder dot turns white on the screen.

Interpreting the Curve

Generally, severe variations or RPM drops between cylinders indicates problems in engine performance.

To pinpoint a weak cylinder, find the cylinder that appears low on the curve. Because of engine dynamics, the weak cylinder is usually the one **BEFORE** the low cylinder on the curve. In larger V-8's, the weak cylinder may appear two or even three cylinders before the low cylinder on the curve under acceleration.

A good acceleration curve will show all cylinder firings within 50 RPM of each other, with only minor variations.

Consult the *Help* screens for detailed information.

Cylinder Contribution Test

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

When the test is selected, the *Cylinder Contribution* screen appears (see Figure 3-39). This screen displays the live RPM readings for each cylinder.

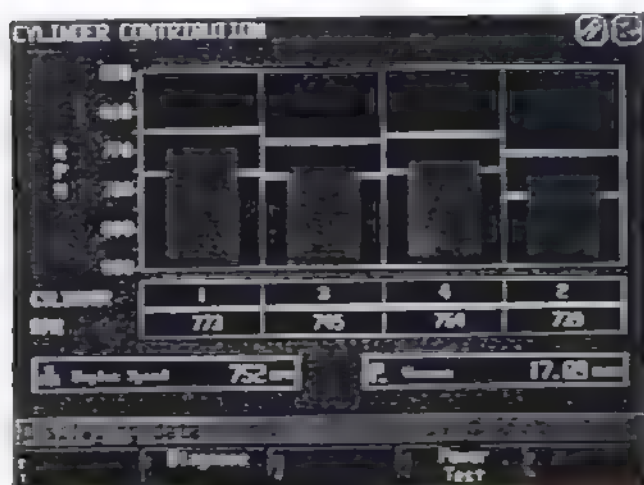


Figure 3-39

The gray bars represent the minimum and maximum readings for each cylinder.

Press:

- [F2] – to run the *Cylinder Efficiency* test;
- [F4] – to run the *Power* test;
- [F9] – to clear the display and begin displaying new information.

Cylinder Efficiency (Conventional Ignitions)

The *Cylinder Efficiency* test measures the relative power contribution of each cylinder to overall engine performance. The test measures power lost when each cylinder is inhibited. Then the computer calculates the relative contribution of each cylinder and displays that information on the screen in the form of a bar graph.

The *Cylinder Efficiency* data screen appears when this test is selected (see Figure 3-40). The message "SHORTING CYLINDER #n" (where 'n' denotes the cylinder number) appears.

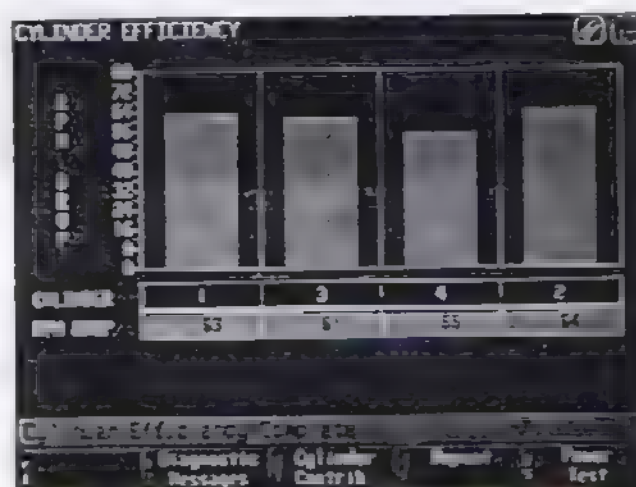


Figure 3-40

After the data has been collected, the computer calculates the results and displays the RPM Drop Values in the boxes under the graph.

Press:

- [F2] – display Diagnostics;
- [F3] – display the *Cylinder Contribution* screen (the "live" screen for this test);
- [F4] – repeat the test;
- [F5] – run the *Power* test.

The vertical bars represent the power LOST when a cylinder is "killed." The taller the bar, the greater the power loss. There is a bar for each cylinder, arranged in firing order.

The light blue box which appears behind the green bars represents the average RPM for the vehicle. Any bars which appear in red are below the average, and represent a weak cylinder.

Cylinder Power Check

Cylinder Power Check allows the operator to "kill" cylinders and watch the resulting changes in engine RPM, HC, CO, CO₂, and O₂. This information allows the operator to evaluate the performance of individual cylinders. This test will provide better results on older engines or on engines which are running roughly.

Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum Pressure Transducer
- Exhaust Gas Analyzer Lead

Recommended Lead Hookup:

- Connect all leads per Figure 1-27

NOTE Power Check does NOT apply to DIS vehicles.

NOTE Some computer-controlled fuel management systems attempt to compensate for RPM loss during *Power Check*. You can often disable this compensating feature according to the vehicle manufacturer's instructions. However, it may be easier to run a *Cylinder Efficiency* test, which will not trigger the computer compensation.

Even if the engine is computer controlled, you may want to run the *Power Check*. If the computer is working properly, you will see the RPM compensation as cylinders are inhibited. When finished, remember to re-connect any components disconnected from the vehicle.

The *Power Check* screen appears (see Figure 3-41).

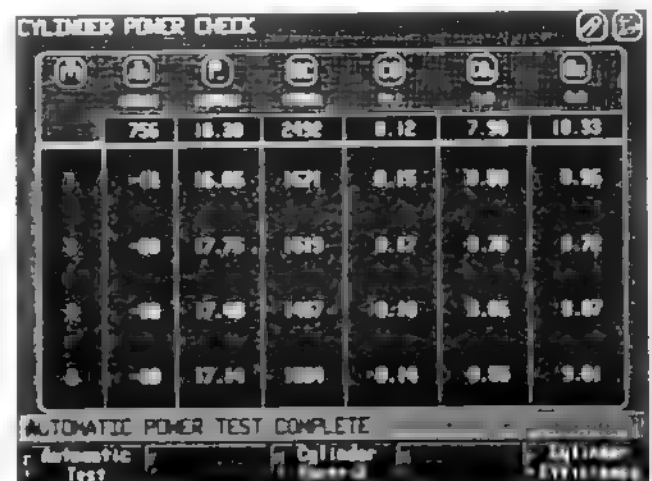


Figure 3-41

Follow the screen prompt or press:

- [F1] – to toggle between "Manual" and "Automatic" testing.
- [F3] – to return to the *Cylinder Contribution* screen.
- [F5] – to go to the *Cylinder Efficiency* screen.

Automatic Testing

The automatic sequence will inhibit each cylinder in firing order, one at a time.

Manual Testing

Make sure that the engine is running at a stable RPM. For manual testing, type in the cylinder number(s) to inhibit. The analyzer then inhibits the cylinder and displays the various readings on the chart on the screen. Type the number of an inhibited cylinder to release that cylinder.

Cylinder Performance (DIS Vehicles)

If you enter specifications for a DIS vehicle, the analyzer will automatically run the *Cylinder Performance* test. The computer calculates the relative contribution of each cylinder and displays that information on the screen in the form of a bar graph.

Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- DIS Secondary Leads

Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

1. Press [F2] (Diagnose) to start the *Cylinder Performance* test. The *Cylinder Performance* meter screen appears (see Figure 3-42). Adjust the vehicle's engine to provide a stable RPM reading, and then press [F2].
2. The *Cylinder Performance* data screen and the message "SETTING UP FOR CYLINDER PERFORMANCE" appears.

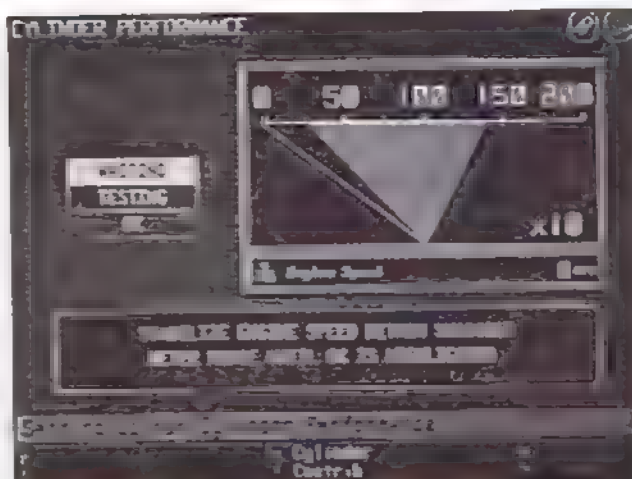


Figure 3-42

After the data has been collected, the computer calculates the results and displays the cylinder rating values in the boxes under the graph.

Press:

- [F2] – to display Diagnostics;
- [F3] – to display the *Cylinder Contribution* screen, the "live" screen for this test;
- [F4] – to repeat the test.

Multi-Analyzer Menu

This menu provides a series of multimeters and lab scopes for displaying and analyzing “live” vehicle data.

From the *Service Tools* menu use the arrow keys or press [5] and [ENTER] to access the *Multi-Analyzer* menu.



Figure 3-43

Multi-Adjustments

The *Multi-Adjustments* screen allows the operator to see the "live" results of any adjustments made on the test vehicle.



Figure 3-44

The “default” meters (RPM and dwell) will always appear when *Multi-Adjustment* is selected. Use the right- and left-arrow keys to select an active meter in order to change it to another meter. Active meters are indicated by the yellow border around the meter. All of the digital meters except for the timer and temperature can be displayed as analog meters. Press the number of the digital meter to display that meter as an analog meter. Digital meters colored in gray are not available for meter display, either because they do not apply, or because they are turned “OFF.”

From the "Multi-Adjustment" screen, press:

- [F1] – to toggle the timer “ON” and “OFF;”
- [F2] – to toggle the trace function “ON” and “OFF;”
- [F3] – to *Zero Center* the analog meters.
The *Zero Center Meter* icon appears in the lower left corner of the active analog meter.
- [F5] – to toggle the timing light “ON” and “OFF.”

Multi-Meter

The "default" meters (RPM and current) will always appear when *Multi-Meter* is selected.

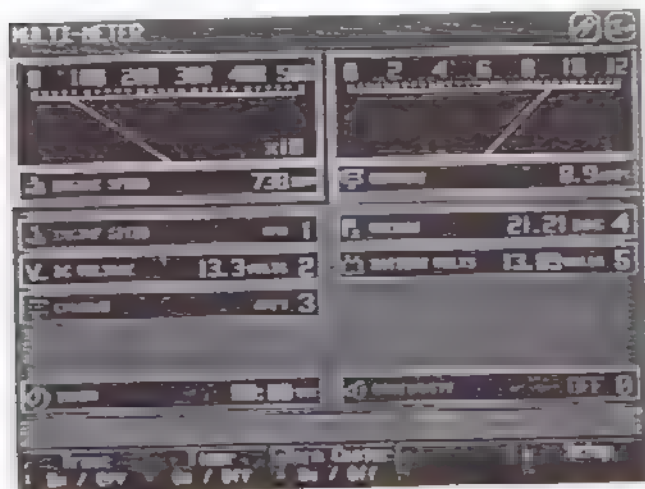


Figure 3-45

Use the right- and left-arrow keys to select an active meter in order to change it to another meter. Active meters are indicated by the yellow border around the meter. All of the digital meters except for the timer can be displayed as analog meters. Press the number of the digital meter to display that meter as an analog meter. Digital meters colored in gray are not available for meter display, either because they do not apply, or because they are turned "OFF."

From the *Multi-Meter* screen, press:

- [F1] – to toggle the trace function "ON" and "OFF."
- [F2] – to toggle the timer "ON" and "OFF."
- [F3] – to Zero Center the analog meters. The *Zero Center Meter* icon appears in the lower left corner of the active analog meter.
- [F5] – to display the *Multi-Meter Setup* screen (see Figure 3-46).
- [0] – to toggle the continuity tester function "ON" and "OFF."

Changing the Multi-Meter Setup

Type the number of the leads configuration you wish to use. A check will appear in the box next to the list (see Figure 3-46).

Press:

- [F2] – to return to the *Multi-Meter* screen;
- [F3] – to zero the amp probe;
- [F4] – to zero the vacuum/pressure transducer.

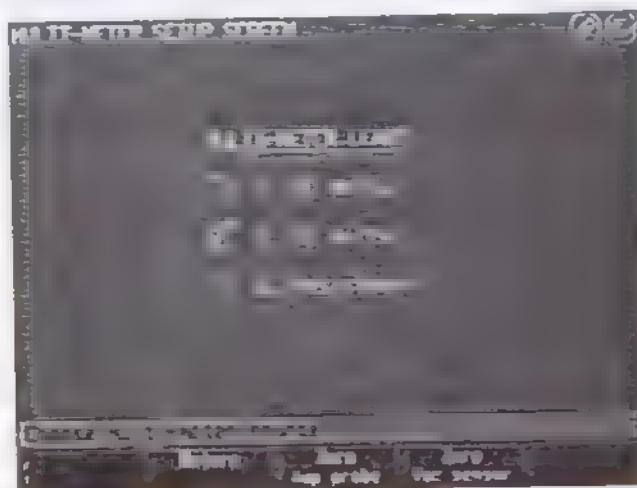


Figure 3-46

Multi-Meter Ranges

1. AC Voltage:
0 to 60 Volts AC RMS.
2. DC Voltage:
0 to +/-50 Volts DC, high-impedance (10 megohm) meter.
3. Resistance:
0 to 2 megohms.

Multi-Scope

During this test the analyzer converts voltage readings from any electrical device into a waveform on the display screen. Display any electrical pattern ranging from +/- 25 volts, freeze it, and analyze it for voltage changes over millisecond time periods.

The *Dual Trace Scope* compares waveforms from two different components; for example, the Crank/Cam sensor and an injector. If you know what their respective waveforms look like compare the two to see if the injector is firing at the wrong time because it is receiving a bad signal from the Crank/Cam sensor.

1. Select *Multi-Scope* from the *Multi-Analyzer Menu*.

☐ **NOTE** If you have not previously selected a vehicle specification, the *VEHICLE SETUP QUICK SPEC ENTRY* screen will appear. Make any changes necessary to the settings listed in this screen (refer to *Quick Spec Entry* in Chapter 1 for details). Press [F2] to continue.

2. The *DUAL TRACE SCOPE* screen will now appear (see Figure 3-47).

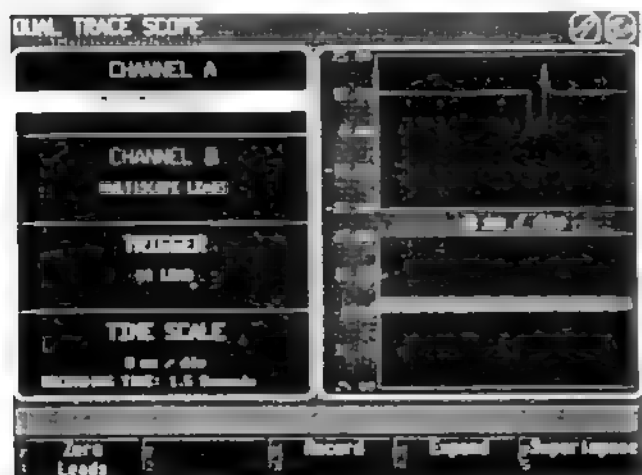


Figure 3-47

3. You may change the source leads for channels A and B, the trigger source, and the time scale as necessary. To change the source leads, use the up- or down-arrow keys to highlight the channel of your choice (A or B) and press [ENTER] (see Figure 3-48).

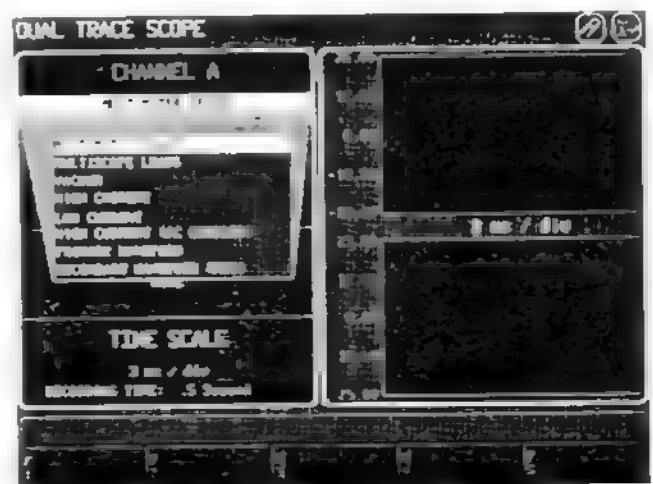


Figure 3-48

A drop-down menu will appear (see Figure 3-49). Highlight the correct source lead and press [ENTER].

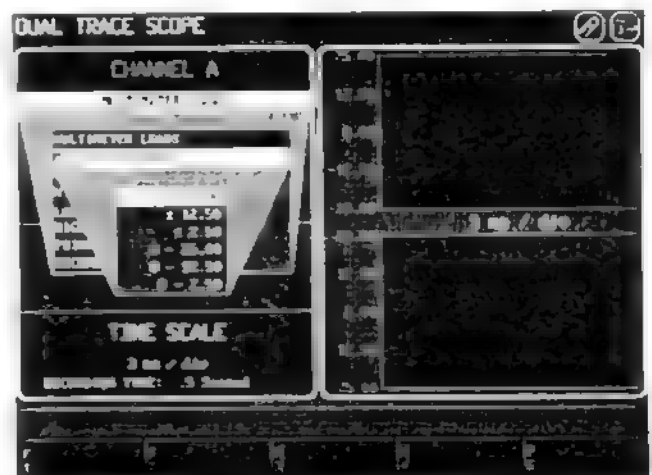


Figure 3-49

Synchronizing the Pattern

When a pattern is not synchronized, it will often be hard to read because its position on the screen is not controlled.

To stabilize the pattern on the screen, synchronize the pattern so that it is triggered by some event, such as the beginning of an injector pulse. When synchronized, the pattern begins at the left edge of the screen, where the triggering event occurs.

4. To change the trigger source, use the up- or down-arrow keys to highlight the **TRIGGER** source selection and press [ENTER]. A drop-down menu will appear (see Figure 3-50). Highlight the correct trigger source and press [ENTER].

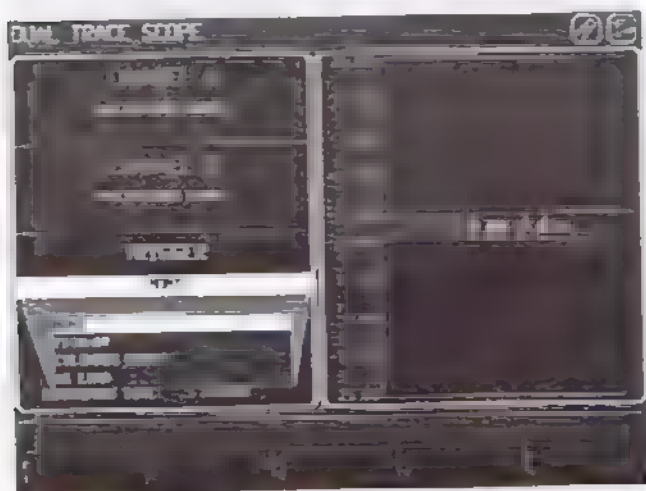


Figure 3-50

5. To change the time scale, use the up- or down-arrow keys to highlight the **TIME SCALE** selection and press [ENTER]. A drop-down menu will appear (see Figure 3-51). Highlight the correct time scale and press [ENTER].

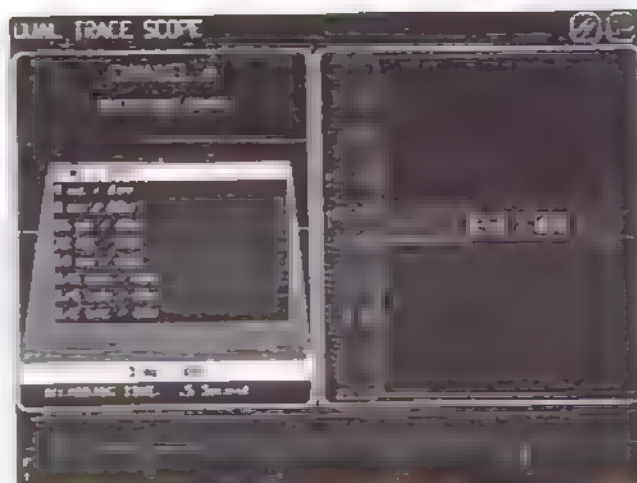


Figure 3-51

6. Connect the trigger lead to any point that will serve as a trigger. The trigger lead can be connected to the same point as the source lead.

Start the engine. The waveforms will appear in the display halves of the boxes.

Press:

- [F1] – to zero all leads used in this test;
- [F3] – to record patterns;
- [F4] – to expand the scope meters to full screen (see Figure 3-52);
- [F5] – to superimpose both patterns in one meter screen (see Figure 3-53).

Expanded Dual-Trace Scope



Figure 3-52

From the expanded screen, press:

- [F2] – to return to the *Dual Trace Scope* screen. This allows the operator to make any necessary adjustments to triggers, voltage or time scales.
- [F3] – to “freeze” the pattern on the screen. The analyzer then stops (freezes) the waveforms on the screen and displays time flags and voltage readings at particular times. The flags are spaced apart according to the time scale selected from the *Dual Trace Scope* screen. To “unfreeze” the patterns and resume play press [F3] again.
- [F5] – to toggle between expanded waveforms (see Figure 3-52) and superimposed waveforms (see Figure 3-53). This allows close comparison of both waveforms over time.

Note the digital displays in the lower left corner of the screen, under the scope display. The read-outs display the voltage time in milliseconds and frequency in hertz, at each test point marked by a flag, when *Freeze* is selected.



Figure 3-53

High Current Probe: Selecting this item allows you to use the light-grey high-amp probe as a DC-coupled trigger and display source. DC-coupling couples all frequency components of the trigger signal to the trigger and display circuitry. It is useful for most signals, but is especially useful for providing a stable display of signals with low frequencies or low repetition rates. It will display exactly and proportionally the signal and value being measured.

The typical use for this selection is for examining the average amperage values of a high current waveform, for example, starter motor draw. Highlight this item using the up and down arrow keys, then press [ENTER].

High Current Probe (AC COUPLED): This selection will use the light-grey high-amp probe as a trigger and display source, but the signals will be AC coupled into the analyzer. AC coupling capacitively couples the input signal to the vertical deflection circuitry of the oscilloscope screen. This method of coupling blocks the DC component of the signal input. Only the fluctuating, or changing, portion of the waveform will be displayed on-screen.

AC coupling is useful for viewing small AC waveforms having large DC offsets, such as per-cylinder changes in cranking or charging waveforms. Highlight this item using the up and down arrow keys, then press [ENTER].

Selecting this item will cause the *Voltage Scale* selection menu to pop out. Make your selection by highlighting the desired voltage scale using the up and down arrow keys, then press [ENTER].

Printing Reports



This option is available only after pressing [F3] to freeze the waveforms.

Press [F3] to freeze the screen display. Adjust the flags as necessary and then press [F12] to print the *Dual Trace Scope* data report. The report lists the customer information and the values recorded at the flag locations on the screen.

Moving Flags

Only one flag can be moved at a time. To select a flag, press the corresponding number. The number on the active flag will appear larger. Press the arrow keys to move the flags. This allows the operator to check and compare voltages at any particular time.

Uniscope

The *Uniscope* allows the operator to examine a single waveform at various speeds and update rates with or without a trigger from the engine.

When the test is selected, the *Uniscope* screen appears (see Figure 3-54).

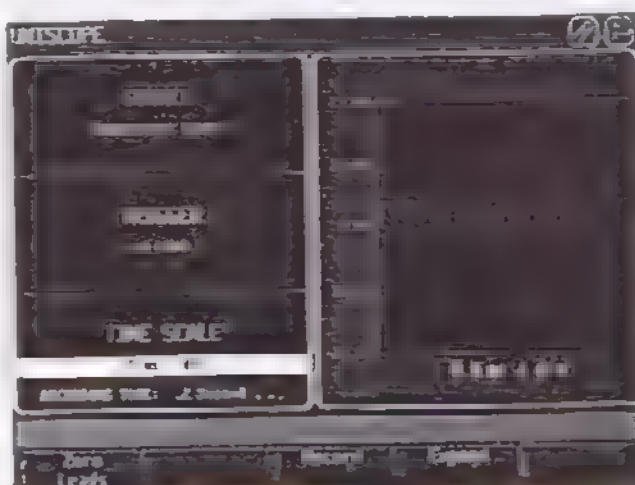


Figure 3-54

Synchronizing the Pattern

When a pattern is not synchronized, it will often be hard to read because it will be scrolling across the screen.

To stabilize the pattern on the screen, synchronize the pattern so that it is triggered by some event, such as the beginning of an injector pulse. When synchronized, the pattern begins at the left edge of the screen, where the triggering event occurs.

The cursor will appear in the trigger box. Press [ENTER]. The trigger menu will pop out. Use the arrow keys to select a trigger and press [ENTER].

The pop-out menu will disappear. Press the arrow keys to move the cursor to the next block. Select the correct channels and time scales as needed.

Press

- [F1] – to zero all leads used in this test.
- [F3] – to record patterns.
- [F4] – to expand the scope meters to full screen.

Connect the trigger lead to any point that will serve as a trigger. The trigger lead can be connected to the same point as the source lead.

Start the engine, if necessary. The waveforms will appear in the display halves of the boxes. Press:

- [F3] – to record the patterns.
- [F4] – to expand the pattern display to take up the entire screen (see Figure 3-55).

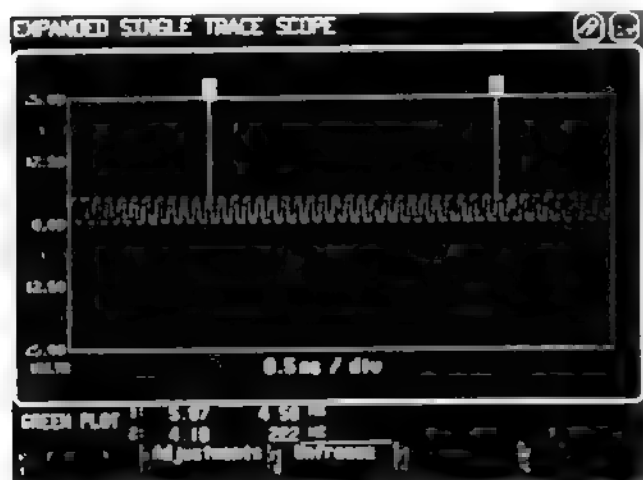


Figure 3-55

From the *Expanded* screen, press.

- [F2] – to return to the *Uniscope* screen. This allows the operator to make any necessary adjustments to triggers, voltage or time scales.
- [F3] – to “freeze” the pattern on the screen. The analyzer then stops (freezes) the waveforms on the screen and displays time flags and voltage readings at particular times. The flags are spaced apart according to the time scale selected from the *Uniscope* screen.

To “unfreeze” the patterns and resume playback, press [F3] again.

High Current Probe: Selecting this item allows you to use the light-grey high-amp probe as a DC-coupled trigger and display source. DC-coupling couples all frequency components of the trigger signal to the trigger and display circuitry. It is useful for most signals, but is especially useful for providing a stable display of signals with low frequencies or low repetition rates. It will display exactly and proportionally the signal and value being measured.

The typical use for this selection is for examining the average amperage values of a high current waveform, for example, starter motor draw. Highlight this item using the up and down arrow keys, then press [ENTER].

High Current Probe (AC COUPLED): This selection will use the light-grey high-amp probe as a trigger and display source, but the signals will be AC coupled into the analyzer. AC coupling capacitively couples the input signal to the vertical deflection circuitry of the oscilloscope screen. This method of coupling blocks the DC component of the signal input. Only the fluctuating, or changing, portion of the waveform will be displayed on-screen.

AC coupling is useful for viewing small AC waveforms having large DC offsets, such as per-cylinder changes in cranking or charging waveforms. Highlight this item using the up and down arrow keys, then press [ENTER].

Selecting this item will cause the *Voltage Scale* selection menu to pop out. Make your selection by highlighting the desired voltage scale using the up- and down-arrow keys, then press [ENTER].

Printing Reports

NOTE This option is available only after pressing [F3] to freeze the waveforms.

Press [F3] to freeze the screen display. Adjust the flags as necessary and then press [F12] to print the *Uniscope* data report. The report lists the customer information and the values recorded at the flag locations on the screen.

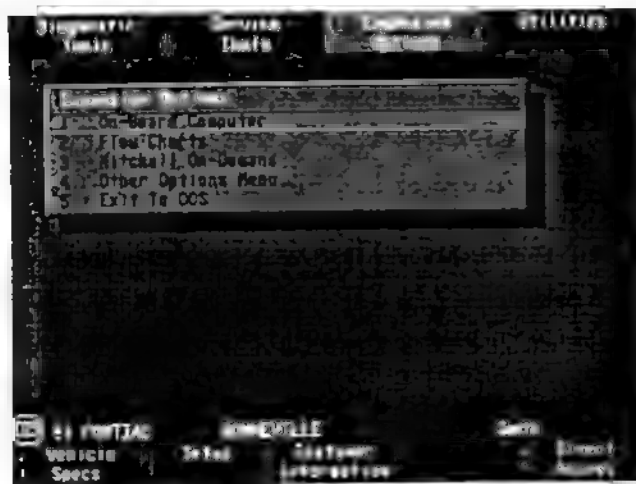
Moving Flags

Only one flag can be moved at a time. To select a flag, press the corresponding number. The number on the active flag will appear larger. Press the right- and left-arrow keys to move the flags. This allows the operator to check and compare voltages at any particular time.

Note the digital displays in the lower left corner of the screen, under the scope display. The readouts display the voltage time in milliseconds and frequency in hertz, at each test point marked by a flag when *Freeze* is selected.

Chapter 4

Expansion Options



This menu provides access to optional modules that you may have installed on your analyzer. The following items may appear on the menu and some are described in more detail in the sections that follow.

On-Board Computer — This item allows access to on-board computer information from Chrysler, GM, Ford, and some import makes. The engine analyzer manipulates that information to allow you to read fault codes and system sensors, read data stream information and run manufacturer self-test procedures.


Flow Charts Menu — This item displays a menu of the optional Flow Chart procedures that apply to the current vehicle specifications. Flow Charts is a CD-ROM based module that allows you to diagnose engine operational problems in a step-by-step manner.

Emission Certification — This item will appear if Global Gas software has been installed on the unit. Global Gas provides exhaust gas measurements and international emission testing capabilities. This product is not part of the standard software kit. It is purchased separately.


Mitchell On-Demand — This item appears if the DOS version of Mitchell On-Demand is installed. Mitchell On-Demand is a CD-ROM based database of vehicle information and diagrams. Year/make/model pass-through software uses the current vehicle specifications to start Mitchell On-Demand at the appropriate location in their menuing system so that you will not have to re-select the vehicle.

Other Options Menu — This item displays a menu of options which you may customize for other commercially available software that you have installed on your unit. Items can easily be added to the menu by providing a title and the name and path for executing the program.


Main Icons





Press [F7] to see Lead Status Screen. Flashing icon indicates problem with one or more leads.





Press [F10] to display previous menu screen.



DIS Specs Loaded.





Arrow Keys are active – press the appropriate arrow to scroll up or down a text screen, or move the highlight from one meter to another.

Continued

Exit To DOS— This item allows you to exit the analyzer software and enter the DOS environment.

Smoke Meter — This item appears if the Smoke Meter software is installed on the unit. It provides diesel vehicle exhaust opacity testing. This product is not part of the standard software kit. It is purchased separately and includes additional test leads.

Other supported products may appear on the menu when they are installed on the unit. Generally, the modules do not appear on the menu unless they are installed, and, will appear ghosted if the current vehicle specification is not supported by the module.

Hot Keys

- [F7] — **Trigger Lead Status** — Displays *Trigger Lead Status* screen.
- [F8] — **Kill** — Stops the engine.
- [F9] — **Clear** — Clears data fields and displays.
- [F10] — **Previous Menu** — Aborts the test in progress and returns to the previous menu or proceeds to the next test in a user test.
- [F11] — **Form Feed** — Form feeds paper from the printer.
- [F12] — **Print Reports** — Displays the "Print Reports" menu.
- [Print Screen] — Prints a "screen dump" - an exact copy of what appears on the screen.

Task Switching

Using the Flow Charts program or the AD-Net Scan Tool with the 40-400 Professional Work Station provides you with "Task Switching" capability. Task Switching allows you to "leave" the 400 Engine Analyzer, Flow Charts, OBC Scan Tool, or certain other functions to retrieve data from another software module installed in the 400 unit.

When other available software modules are installed in the 400 unit, the [F1] key on the module main menu changes to "Select Module." For example, if you are in the OBC Scan Tool module, and Flow Charts is installed, the [F1] key on the OBC menu changes to "Select Module." If you are in Flow Charts, and OBC Scan Tool is installed, the [F1] on the main Flow Charts menu changes to "Get Measurement." Once you have obtained the desired measurement, you can then return to the original module and continue the programmed test where you left it.

To select another software module:

1. Return to the software module's main menu.
2. Press [F1].
3. Use the Arrow keys to select the desired module and press [ENTER].

On-Board Computer (OBC)

About the OBC Function

The On-Board Computer function allows access to on-board computer information from Chrysler, GM, Ford and some import makes. The engine analyzer manipulates that information to allow you to:

- read fault codes and system sensors
- read data stream information
- run manufacturer self-test procedures

NOTE This section provides a brief overview of the OBC function. For detailed instructions on the use of the OBC function, consult the AD Net Scan Tool Operation and Maintenance Guide (P/N 520-05604).

This function interacts closely with manufacturer computers, and follows manufacturer test procedures. Each manufacturer has a number of different systems.

Many malfunctions that appear to be related to computer systems are actually the result of mechanical breakdown, poor electrical connections, or damaged vacuum hoses, rather than problems with computer system components themselves. For this reason, it is recommended that you always run a Quick Comprehensive Test after using the OBC Module to diagnose computer systems.

Software Updates

If a software update is performed on the analyzer, there will be a software mismatch between the analyzer and the Scan Tool. This will require downloading the appropriate software from the analyzer to the Scan Tool. This is a completely automatic process, and only requires the operator to perform the following procedure:

1. Select *On-Board Computer* from the *Expansion Options* menu.
2. The "AD-OBC Initializing..." screen will appear. At this point, the analyzer communicates with the Scan Tool; detects the software mismatch, and displays a warning message (see Figure 4-1).

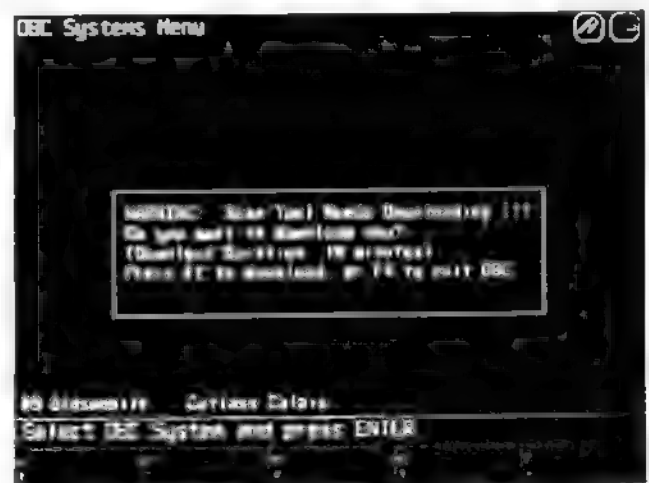


Figure 4-1

if you press [F4] to abort this process and exit the OBC function, the analyzer will still need to perform this operation before OBC can be used again.

Flow Charts

- Press [F2] to perform the download. The process will take about 10 minutes. When it is finished, the analyzer will be ready to perform OBC functions.

NOTE

If the warning message in Figure 4-1 appears when the operator accesses the OBC function on the analyzer and no software update has been performed recently, it is most likely the result of a corruption of the Scan Tool's downloadable memory. Press [F2] and the analyzer will correct the problem.

Flow Charts is a CD-ROM-based step-by-step diagnostic procedure for computer-equipped vehicles. It guides you through diagnosis of engine operation problems. The diagnosis is based on recommendations from vehicle manufacturer's service manuals.

The 400 Series Analyzer Software stores the Flow Chart information with the vehicle being tested in memory. Press [2] from the *Expansion Options* menu to access the *Flow Charts* program. (see Figure 4-2 and 4-3).

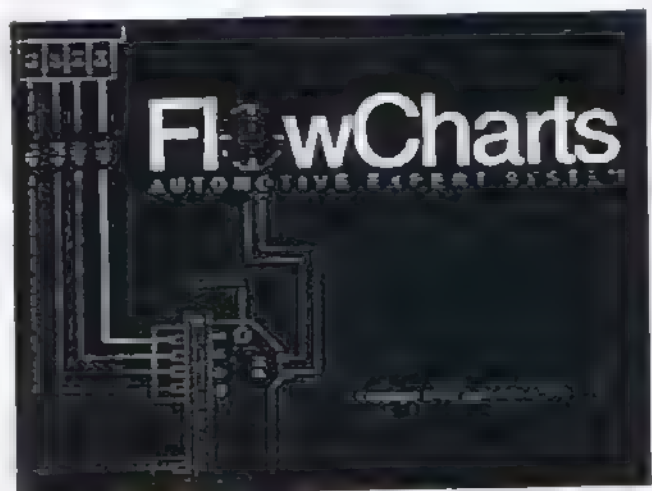


Figure 4-2

Flowcharts Screen example.

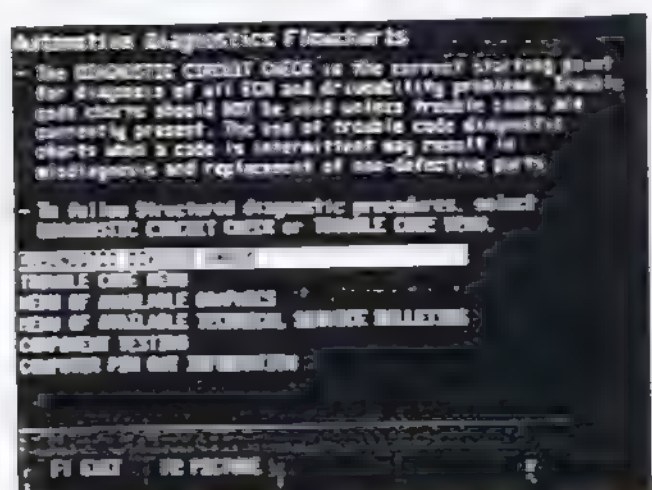


Figure 4-3

Mitchell On-Demand

NOTE Mitchell On-Demand is available in both Windows® and DOS versions. Only the DOS version of Mitchell On-Demand can be installed on to the 400 Series Professional Work Station.

NOTE If the year, make, and model of the vehicle testing specifications entered into the 400 Series match Mitchell database information, Mitchell-supportive 400 Series software will automatically start the Mitchell On-Demand program and supply the specifications to allow it to display the "Category" menu. Year, Make, and Model will show as [F1], [F2], and [F3] selections on the left side of the screen. You may review them as needed by pressing the appropriate key. If only one, or two, of the database items match, you will be required to enter the remaining items to reach the "Category" menu. You may then select any of the available items on the category list to access that function for the specified vehicle.

Other Options Menu

The Other Options Menu contains a list of owner-installed options. You can install any number of popular retail software packages, as well as your choice of shop management packages.

When you install an application using the Other Options Menu, the analyzer computer will have almost the entire 640K of memory available for your programs.

To select the Other Options Menu, press the number key corresponding to the Other Options Menu position on the Expansion Options Menu listing. The menu (see Figure 4-4) appears. (You may also use the arrow keys to highlight the selection, then press [ENTER].)

NOTE: The Other Options menu is not available if Exit to DOS is disabled.

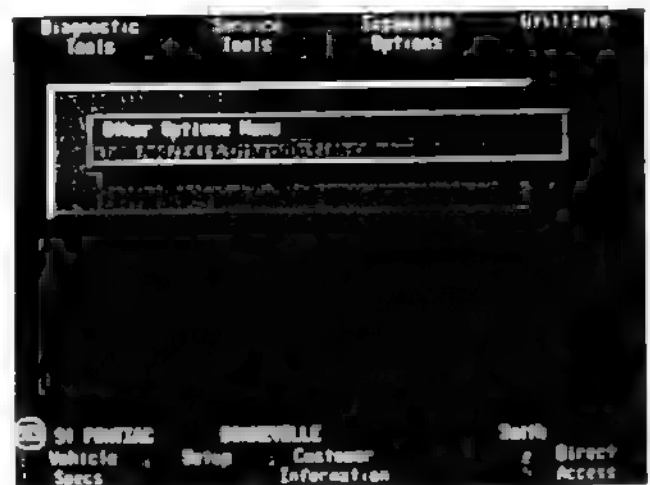


Figure 4-4

Running an Optional Application

To run an optional application from the *Other Options* menu, use the Arrow Keys to highlight the item and press [ENTER], or type the item number.

The computer exits the analyzer software and starts the optional software application.

Return to the Analyzer Software

1. Exit the optional application software (consult the application's User Manual for complete instructions). The cursor is then in the MS-DOS environment.
2. Change to the drive where the analyzer software is located.
3. Type `CD\400` and press [ENTER].
4. Type `400` and press [ENTER].

The analyzer software starts and the title screen appears. Press any key to continue. For more information on steps 2 through 4, consult an MS-DOS reference manual for a complete explanation.

Adding New Options

Depending on the hard disk space available, up to nine (9) applications can be installed on the system. Adding an additional or larger hard drive to the analyzer computer can increase the number and/or size of the optional software applications installed.

If No Options Are Currently Installed:

1. Press [1], *Add/Edit Other Options* to add a new software application to the analyzer. If no options are currently installed, the *Add/Edit Options* screen appears (see Figure 4-5).

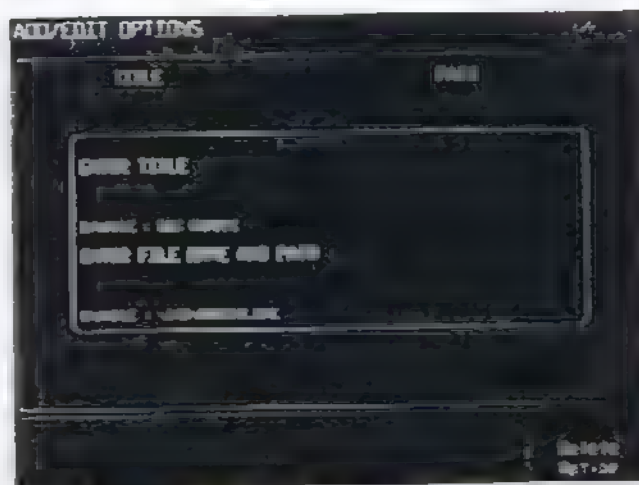


Figure 4-5

2. Enter the title of the optional software program and press [ENTER]. The cursor moves to the next field.
3. Enter the executable file name and path and press [ENTER].
4. Press [F10] to return to the *Other Options* menu. The newly installed optional software application appears in the menu.

If other options are installed, and you want to add another option:

1. From the *Expansion Options* menu, highlight *Other Options*, then press [ENTER].
2. Highlight *Add/Edit Other Options*, then press [ENTER]. A screen similar to the *Add Edit Options* screen in figure 4-6 appears. If you have multiple options installed, their names will be listed.
3. Use the arrow keys to scroll to a blank line, then press [ENTER]. Then, the *Add/Edit Options* screen 4-5 will be displayed.

Screen 4-5 is only displayed first if no other options are currently installed.

4. Enter the title of the optional software program and press [ENTER]. The cursor moves to the next field.
5. Enter the executable file name and path and press [ENTER].
6. Press [F10] to return to the *Other Options* menu. The newly installed optional software application appears in the menu.

Editing an Optional Application Name or Path

1. Select *Add/Edit Other Options* from the *Other Options* menu and press [ENTER]. The *Add/Edit Options* screen will appear (see Figure 4-6).



Figure 4-6

2. The cursor highlights the first option in the list. Use the up- or down-arrow keys to select the option you want to edit and press [ENTER].
3. The dialog box (see Figure 4-7) appears, containing screen prompts. The prompts guide you through the editing of commands that the computer uses to find and run the optional software package.

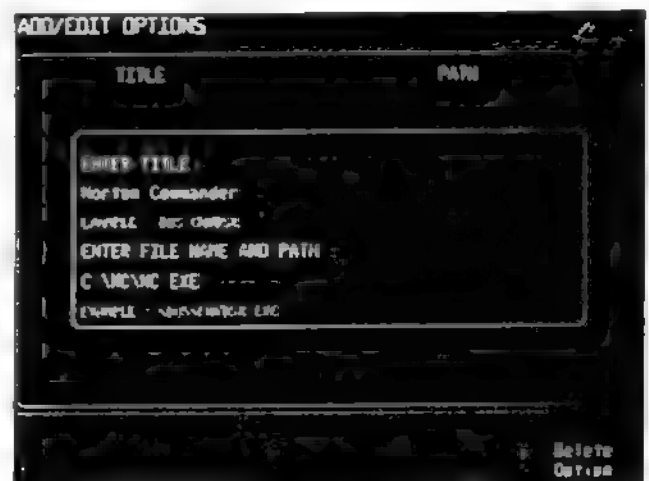


Figure 4-7

4. Type in the required information and press [ENTER]. When you are finished, the option will appear in the list in Figure 4-6.
5. Press [F10] to return to the *Other Options* menu. The edited item appears in the menu.

Exit to DOS

Deleting an Optional Application

1. Select *Add/Edit Other Options* from the *Other Options* menu and press [ENTER]. The *Add/Edit Options* screen appears, (see Figure 4-6).
2. Move the cursor to the optional application in the list that you want to delete.
3. Press [F5]. The analyzer deletes the item from the list.
4. Press [F10] to return to the *Other Options* menu. Note that the optional application is removed from the menu.

Select this menu item any time you wish to leave the analyzer program and go into the MS-DOS environment. Highlight the menu item or type the item number and press [ENTER]. The program will exit the analyzer software and enter MS-DOS.



Do NOT use this function unless you are very familiar with MS-DOS commands and their functions! "Tinkering" in MS-DOS can cause serious software problems, which will result in service call costs to your shop.

To return to the analyzer software from MS-DOS:

1. Change to the drive where the analyzer software is located.
2. Type `CD\400` and press [ENTER].
3. Type `400` and press [ENTER].

The analyzer software starts and the title screen appears. Press any key to continue.

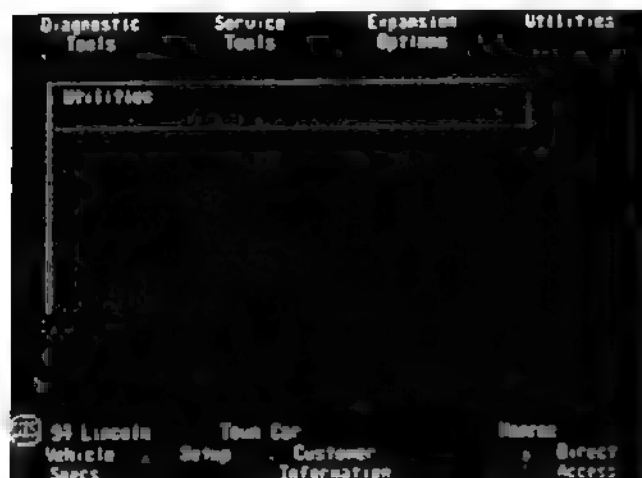
Notes:

[illegible]

Notes:

Chapter 5

Utilities



The "Utilities Menu" provides various administrative and calibration functions. These routines allow you to customize screen displays and report printouts according to your country, unit of measure, etc.

Hot Keys

- [F6] – **Help** — Displays help screens.
- [F7] – **Trigger Lead Status** — Displays "Trigger Lead Status" screen.
- [F8] – **Kill** — Stops the engine.
- [F9] – **Clear** — Clears data fields and displays.
- [F10] – **Previous Menu** — Aborts the test in progress and returns to the previous menu or proceeds to the next test in a user test.
- [F11] – **Form Feed** — Form feeds paper from the printer.
- [F12] – **Print Reports** — Displays the "Print Reports" menu.
- [Print Screen] – Prints a "screen dump", an exact copy of what appears on the screen.

Main Icons



Press [F7] to see Lead Status Screen. Flashing icon indicates problem with one or more leads.



Press [F10] to display previous menu screen.



DIS Specs loaded.



Arrow Keys are active - press the appropriate arrow to scroll up or down a text screen, or change the scale on a meter screen.

Dealer Information

The Dealer Information feature allows you to create custom report headers which will print out your shop name and address along with a sales message on the top of any printed report. The sales message can be up to three lines of 40 characters each in length.

Select 'Dealer Information' from the 'Utilities' menu. The 'Dealer Information' screen appears (see Figure 5-1).

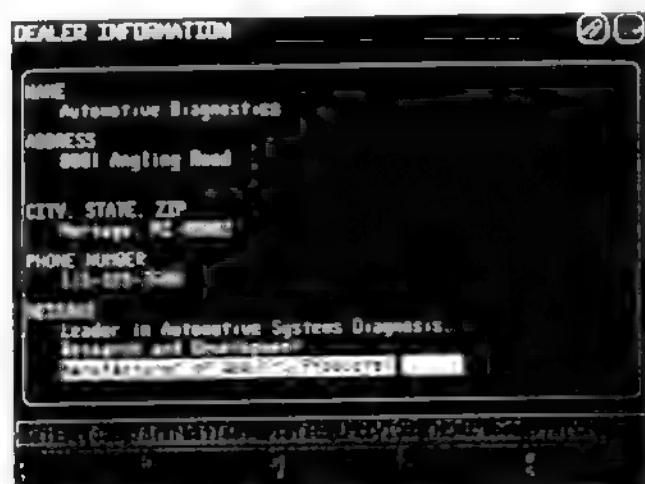


Figure 5-1

Type in the information and then press [ENTER]. The cursor moves to the next line.

If you need to change information entered previously, press [F9] to clear any highlighted field.

When finished, press [F10] to save the information in memory and return to the Previous Menu.

NOTE "Dealer Information" appears on the print-out only when it is selected in the *Engine Analyzer Configuration* function.

Calibrate

The Calibrate menu item features a sub-menu of routines that calibrate various analyzer functions.

Select Calibrate from the Utilities menu and press [ENTER]. A sub-menu appears (see Figure 5-2).

Items 2 and 3 on the menu will appear in gray type and be ghosted if the Gas Analyzer is turned off in the "Engine Analyzer Configuration" screen (refer to Figure 5-19).

NOTE Items 2, 3, and 4 will not appear if Global Gas is installed on the unit. In that case, all gas calibration must be performed in Global Gas.



Figure 5-2

Calibrating Leads

From the "Calibrate" submenu, press [1] and [ENTER]. The "Lead Calibration" screen appears. Follow the instructions on the screen and prepare the analyzer leads for calibration. When all the items listed on the screen have been completed, press [F2] to proceed to the next step.

NOTE "Lead Calibration" must be performed when the leads are disconnected and then reattached to the analyzer or when serviced.

The "Lead Connection" diagram appears (see Figure 5-3).



Figure 5-3

Make sure all the leads are connected correctly as shown in the diagram.

CAUTION Make sure the gray amp probe is connected around the Negative Battery Load Lead - NOT the Negative Battery Cable! The arrow on the probe may point either toward or away from the battery.

Press [F2] to run the calibration routine. The calibration results appear in the boxes under the name of each lead on the screen. If a lead is indicated as "BAD," check the connections again and press [F4] to repeat the calibration routine.

Press [F10] to return to the "Calibrate" menu. Disconnect the leads before beginning the next task.

Calibrate Gas Bench

The Gas Bench calibration is performed by the analyzer software. The analyzer requires a warm-up period before it completes a calibration.

The analyzer calibrates itself using specially formulated gases which are certified for concentration. These gases are stored in the bottle inside the lower left-hand cabinet.

NOTE Refer to "Enter Gas Calibration Values" later in this chapter and make sure the calibration values stored in analyzer memory match those listed on the gas bottle.

To run the calibration procedures, open the valve on the gas bottle and look at the pressure gauge. If the gauge reads less than 20 PSI, replace the bottle. Replacement bottles are available from any authorized service center.

NOTE Always close the gas bottle valve after each calibration.

1. Press [2] and [ENTER] from the Calibrate menu. At this point, the gas analyzer bench will autozero if the analyzer determines it is necessary.
2. Make sure the analyzer probe is removed from the tailpipe. If the sample hose is set up for dual exhaust testing, remove the dual exhaust assembly.
3. Follow the screen prompt and open the calibration gas bottle valve. Press [F2] to begin the test. Prompts appear describing what is happening inside the bench.

Successful Gas Calibration

1. Follow the screen prompts and cover the gas analyzer sample probe with the probe tip cap.
2. Press [F2] to run the leak check.
3. If the analyzer passes the leak check, remove the probe tip cap and press [F2] to return to the 'Calibrate' menu.

Failed Gas Calibration

1. Follow the screen prompts and check the analyzer.
2. Make sure that the gas bottle valve is open (turn the valve counterclockwise.)
3. Check the "Calibration Gas Values" screen against the values printed on the calibration gas bottle. If the two sets of numbers do not match, see the "Enter Gas Calibration Values" section for details on how to enter the correct values into memory.
4. If the message shown in Figure 5-4 appears, run the gas calibration routine again.

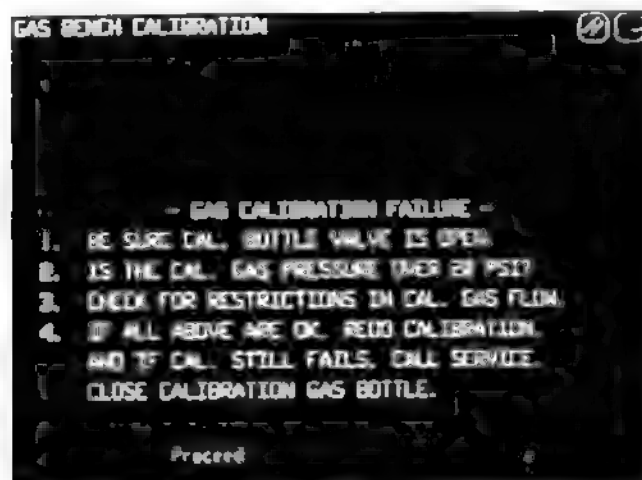


Figure 5-4

5. If the analyzer detects a leak again, remove the sample hose from the gas bench and seal the sample hose inlet fitting (refer to Figure 6-2). Run the routine again. If the analyzer passes the calibration routine, carefully check the sample hose and probe for leaks. If the analyzer fails again, check the following:

| CHECK | FOR |
|-----------------------|--|
| Filter Housing | Cracks or chipped surfaces which might cause leaks. |
| Filter Housing O-ring | Cracks, tears or brittleness, which might cause leaks. |
| Clear Tubing Ends | Cracks |
| Probe Tip Cap | Cracks or tears |
| Sample Hose | Cracks or tears |
| Flexible Probe | Cracks |

If you cannot find a leak and the analyzer will not pass the leak portion of the gas calibration routine, call an authorized service center for repairs.



IF THE ANALYZER FAILS A GAS CALIBRATION, REMEMBER TO REMOVE THE PLASTIC CAP FROM THE PROBE END BEFORE RE-RUNNING THE CALIBRATION ROUTINE!

IF YOU DO NOT REMOVE THE PROBE TIP CAP YOU WILL FAIL ALL SUBSEQUENT GAS CALIBRATIONS!

REMEMBER TO REMOVE THE PLASTIC CAP FROM THE PROBE END BEFORE CONTINUING TO TEST VEHICLES!

Enter Gas Calibration Values

From the "Calibrate" menu press [3], "Enter Gas Calibration Values" and [ENTER]. The "Calibration Value Entry" screen appears (see Figure 5-5).

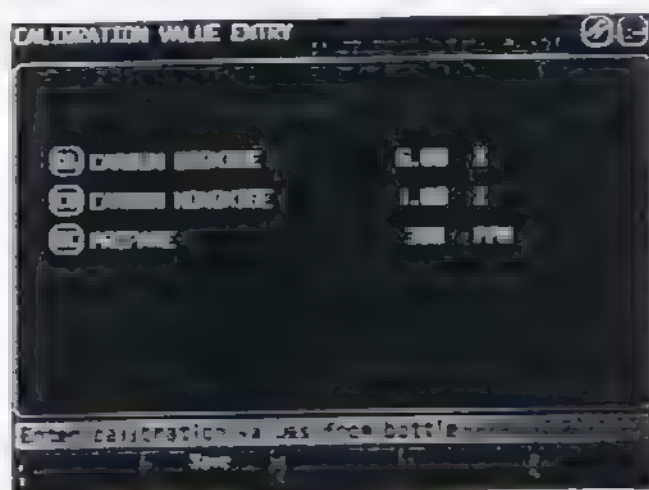


Figure 5-5

This screen displays the values currently saved in the analyzer's memory.

Compare the gas values printed on the calibration gas bottle to those shown on the screen. Change any values which do not match by using the Arrow Keys to move up and down the list. Type in the correct values and press [ENTER] for each item that needs to be changed.

NOTE To replace a value with a newer value containing fewer digits, first fill the field with zeroes (0's) and then type in the new number.

When finished, press [F2]. The new values will be saved in memory and the program will return to the "Calibrate" menu.

Gas Calibration Verification

From the "Calibrate" menu press [4], "Gas Calibration Verification" and [ENTER]. Follow the screen prompt and open the calibration gas bottle valve. Press [F2] to perform the test.

When the analyzer detects stable readings, it will read the actual bench values and display the values on the screen. Figure 5-6 shows the completed screen.

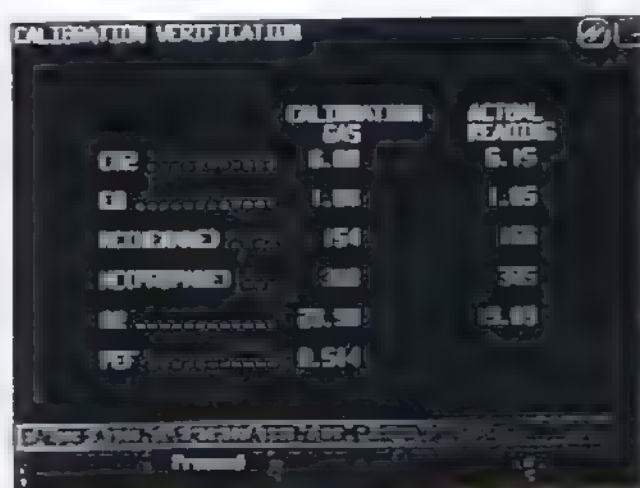


Figure 5-6

Compare the values in each column. If they do not match within a few points, run a Gas Calibration procedure and then run the Gas Calibration Verification routine again. If the values still do not match, call an authorized service technician.

If the values match, press [F2] to return to the "Calibrate" menu.

Diskette Utilities

The 400 Series Analyzer Software comes with a utility designed to format diskettes



Figure 5-7

Formatting Diskettes

Use this utility to format diskettes. Press [3] and [ENTER] from the Diskette Utilities submenu. The Diskette Format screen, Figure 5-8 appears

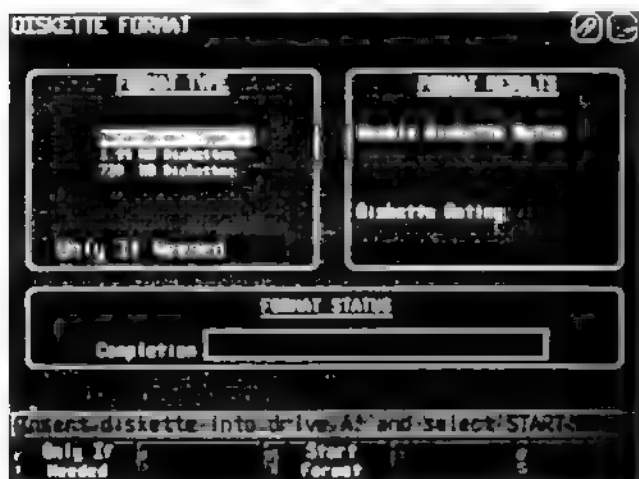


Figure 5-8

The "Format Type" box shows you the format choices available:

- "Auto Select Type" instructs the computer to automatically check the diskette to determine which type of format should be used. To use the "Auto Select" feature, insert a diskette in the drive and press [F3] to start formatting.
- "1.44 MB Diskettes" - formats 1.44 MB diskettes (also known as "High Density").
- "720 KB Diskettes" - formats 720 KB diskettes (also known as "Double Density").

1. Use the Arrow Keys to select the format type.
2. Insert a diskette into the floppy drive.
Press:
 - [F1] – to instruct the computer to check the disk and format it only if necessary;
 - [F3] – to format the diskette according to the format type specified in the "Type" box
3. Press [F10] to return to the previous menu.

Self-Diagnostic Tests

Select "Self Diagnostic Tests" from the "Utilities" menu. The "Self Diagnostics" submenu appears (see Figure 5-9).

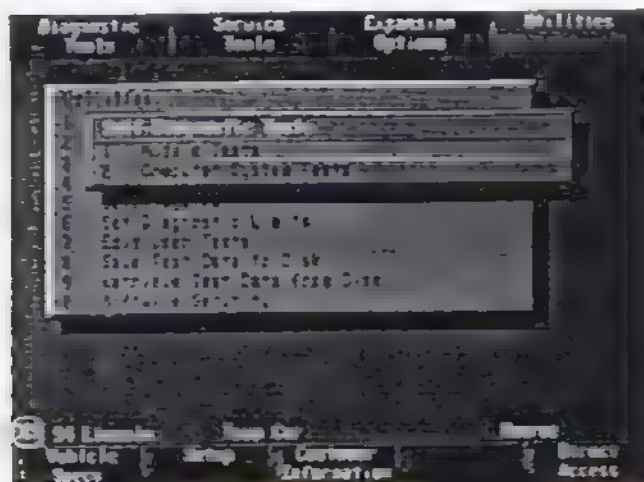


Figure 5-9

Module Tests

From the Self-Diagnostics Tests submenu, move the cursor to highlight Module Tests and press [ENTER]. This routine displays the "Module Status Information" screen (see Figure 5-10).

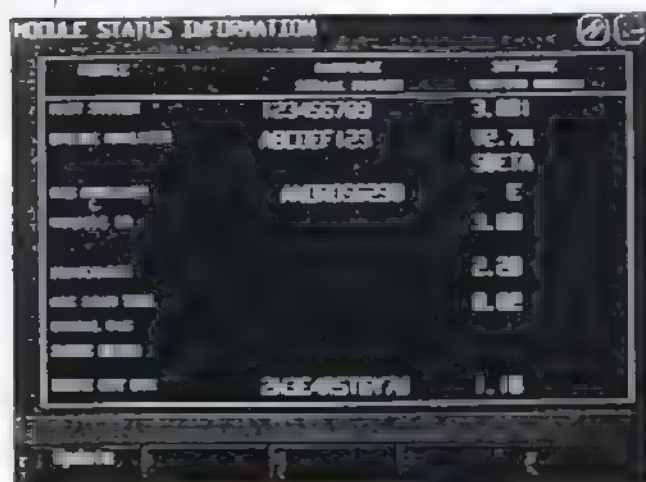


Figure 5-10

The Module Status Information screen lists the version number information for all the accessory options installed on the analyzer.

Update Module Status Information

1. Press [F1] to update the information on the screen after installing a new option or updating an option already on the system.
2. At the flashing cursor, type in the serial numbers of the Engine Analyzer and any other options installed. When you are finished typing, press either the Down Arrow Key or [ENTER] to scroll through the list. The analyzer program queries and displays the version information automatically.

NOTE

When calling an authorized service representative for help with any software problem it is recommended that you print out a copy of the diagnostic report. The service representative will ask you to read back some of the version information before attempting to diagnose a problem.

3. Press [F10] to return to the "Self Diagnostic Tests" submenu.

Setup System

Computer System Tests

From the Self-Diagnostics Tests submenu, move the cursor to highlight Computer System Tests and press [ENTER].

This data screen (see Figure 5-11) shows the computer configuration information

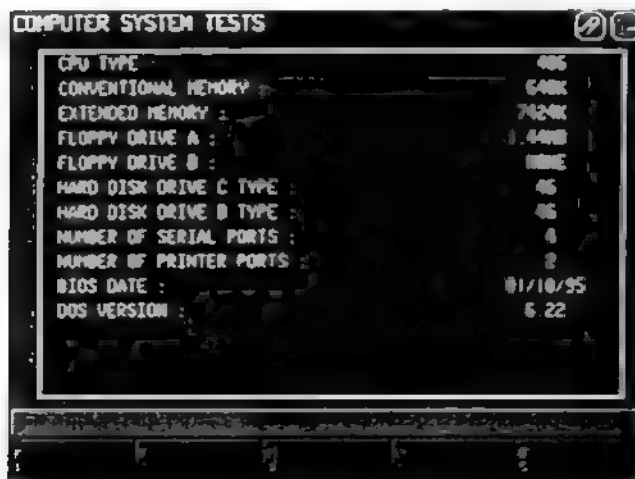


Figure 5-11

An authorized service representative may ask you to display this screen before attempting to diagnose a problem.

Press [F10] to return to the "Self Diagnostic Tests" submenu

Selecting "Setup System" from the "Utilities" menu displays a Setup System sub-menu (see Figure 5-12).



Figure 5-12

Use the Arrow Keys or type in the number of the setup function you wish to use and press [ENTER]

Set Time and Date

This selection allows the operator to enter the correct time and date. The time and date are automatically printed on all customer and technical reports generated by the analyzer.

1. Select "Set Time and Date" from the "Setup System" menu.
2. The "Set Time and Date" screen appears (see Figure 5-13) with the current settings displayed



Figure 5-13

- Press the Up or Down Arrow Key to move the cursor to the setting that must be changed. The cursor will appear in one of the data fields. Type in the correct setting and press [ENTER]. Press [ENTER] to move the cursor from one field to the next.

Press:

- [F3] – to toggle between AM and PM;
- [F5] – to change the time format from AM/PM to 24 hr.

- When finished, press [F10] to save the data and return to the "Setup System" sub-menu.

NOTE

The program does NOT automatically compensate for Daylight Savings Time.

Printer Setup

This function allows you to select an optional printer and change the printer configuration in analyzer memory (see Figure 5-14).



Figure 5-14

Press:

- Arrow Keys** – to toggle between the "Printer" and "Paper" dialog boxes;
- [1] or [2] – to choose the type of printer to be configured in the printer dialog box or the size of the paper in the paper dialog box. Any changes made appear in the "Current Setup" box;
- [F1] – to enter the default setup configuration into memory;
- [F3] – to toggle between available printer ports. The port number will change in the "Current Setup" box.

Set Country Format

This function allows you to change the display character format according to a particular country's requirements

1. Select 'Set Country Format' from the 'Setup System' menu
2. The "Set Country Format" screen appears (see Figure 5-15). The current settings are displayed on the screen

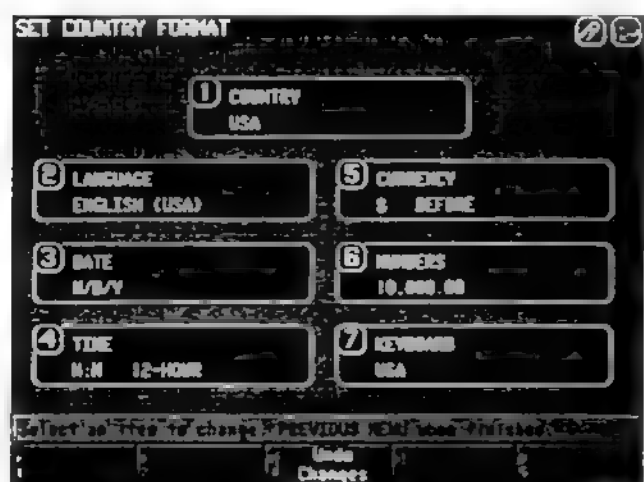


Figure 5-15

3. Press the number of the category to be changed. A dialog box will appear listing the available choices for that particular category (see Figure 5-16).



Figure 5-16

Use the Arrow Keys to move the cursor until the correct choice is highlighted or type in the letter or number of choice. Press [ENTER] to confirm the change. The dialog box will disappear and the new selection will be displayed in the "Set Country Format" screen.

Press

[F3] – to undo any changes made

Time

The time can be displayed on the analyzer and in customer reports in a 12-hour style, a 24-hour (1 p.m.) style, and a military style (13:00).

To change the clock style from a 24-hour style to a military style press [4]. Use the Arrow Keys and select style (A) from the dialog box, (see Figure 5-17). Press [ENTER].



A

Figure 5-17

Set Units

Select this function from the "Setup System" sub-menu to change the measurement system. The "Set Units" screen (see Figure 5-18) provides the following choices for each measurement:

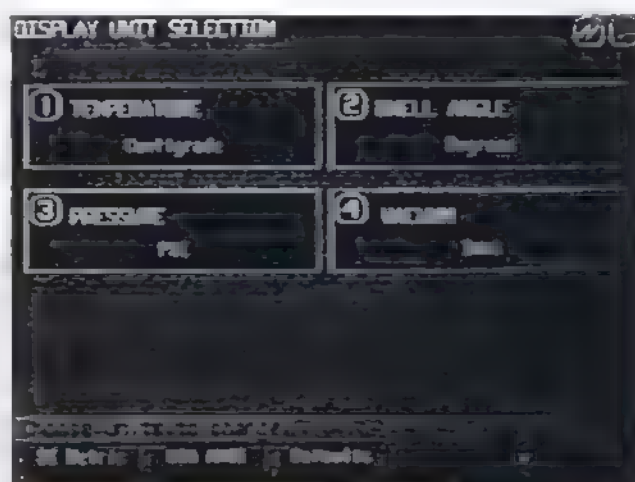


Figure 5-18

Press:

- [1] – to choose between Fahrenheit and Celsius temperature readings. Use the Arrow Keys to highlight the correct entry and press [ENTER] to confirm the choice.
- [2] – to choose between Degree and Percentage dwell readings. Use the Arrow Keys to highlight the correct entry and press [ENTER] to confirm the choice.
- [3] – or [4] to choose between the following Pressure and Vacuum units:
 - PSI - pounds per square inch
 - KPA - kilo pascals per
 - INHG - inches of mercury
 - Bars
 - Torr
- [F1] – to load SI (metric) units.
- [F2] – to load ANSI units. ANSI units are generally used for American/English defaults.
- [F3] – to load default units into memory. The default units are the same as the USA ANSI settings.

Engine Analyzer Configuration

From the Setup System submenu, press [5] and [ENTER] to access the Engine Analyzer Configuration screen. The "Engine Analyzer Configuration" screen (see Figure 5-19) allows customization of the analyzer operation.

Use the Arrow Keys to move the cursor up and down the list. Press [ENTER] to toggle the particular function "ON" and "OFF."

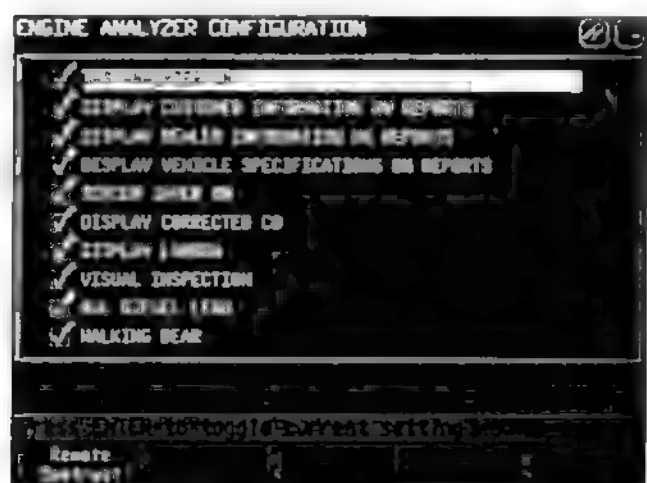


Figure 5-19

The "Gas Analyzer" is set to "ON" by default (box contains a check mark), displaying Gas Analyzer readings and messages in the event of problems with the exhaust analyzer.

The "Display Customer Information," "Display Dealer Information," and "Display Vehicle Specifications" settings customize the customer report format. It is recommended that specifications are printed on each report, to see where a vehicle tested out of spec, and to verify that the specification in memory is correct. If a specification for a vehicle isn't correct, modify it using "Vehicle Specifications," [F1], from any menu screen.

A "Screen Saver" is a moving pattern that appears on the display monitor after you have not used your computer for an amount of time. It provides less wear on, and longer life of, the monitor's Cathode-ray Tube. Other selections may appear for individual screen savers.

"Corrected CO" set to "ON," is displayed in the Four Gas Live screens.

"Display Lambda" set to "ON," is displayed in the Four Gas Live screens.

"Visual Inspection" set to "ON," appears as a step in the Quick Comprehensive Test.

"AVL Diesel Lead" set to "ON" indicates that an AVL Lead has been installed on the unit and should be used for diesel synchronization. Set to "OFF" indicates that the Green #1 Lead should be used.

The last option on the screen determines whether or not the "Walking Bear" will be displayed on the title screen.

Press:

- [F1] – to adjust the hand-held remote display contrast and brightness (see Figure 5-20). The default is set to 25. Use the Arrow Keys to set the contrast level from 1 to 50. Press [F10] to return to the previous menu screen. The contrast level is stored until the remote contrast is adjusted again.

Set Diagnostic Limits

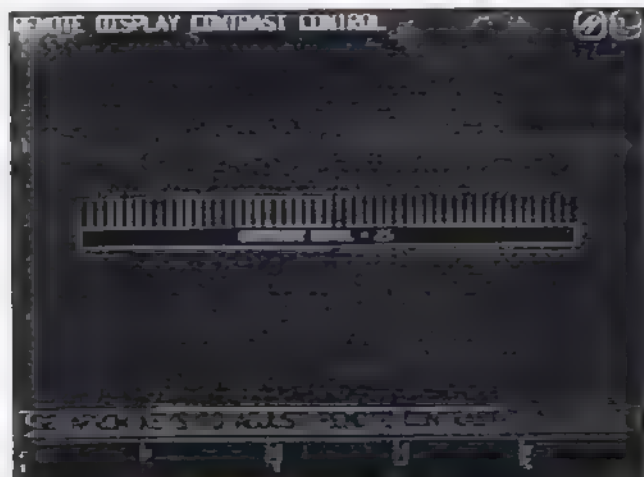


Figure 5-20

This function allows Gas Analyzer diagnostic limits to be set for various model-year vehicles. The analyzer compares emission readings to the values stored in memory and flags emission readings as good or bad, then generates diagnostic messages to assist in diagnosis and troubleshooting.

Select "Set Diagnostic Limits" from the "Utilities" menu. The "Set Diagnostic Limits" screen appears (see Figure 5-21).

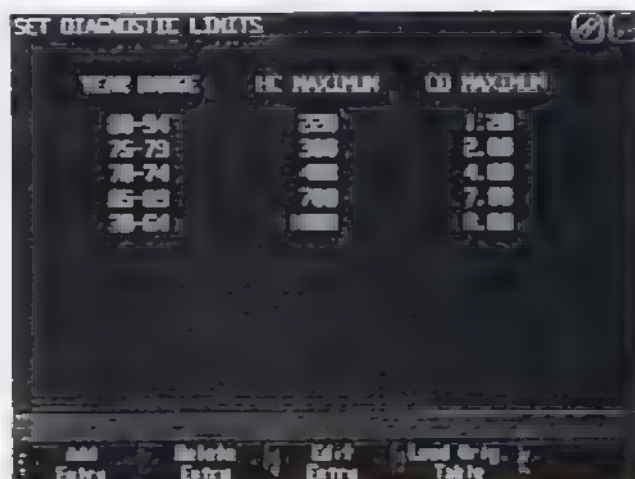


Figure 5-21

Press:

- [F1] — to add an entry to the list. The cursor appears at the bottom of the list. Type in the required information in each column. Press [ENTER] to move the cursor to the next column.
- [F2] — to delete an entry from the list. The first entry in the list will be highlighted. Use the Arrow Keys to move the cursor up and down the list. Press [ENTER] to delete the highlighted entry.

Edit User Tests

- [F3] – to edit an entry. The first entry in the list will be highlighted. Use the Arrow Keys to move the cursor up and down the list. Press [ENTER] to edit the highlighted entry. A red cursor will appear. Type in the new values and press [ENTER] to move the cursor to the next column.
- [F4] – Loads the default table (shown in Figure 5-21) into computer memory.

This menu item allows you to create a custom user test called a 'Group Test.' The Group Test can contain any sequence of options or tests in the 'Test List.'

For best test performance, always place the options 'Specification Entry' and 'Customer Information' in the number 1 and 2 positions, respectively in any group test.

Select "Edit User Tests" from the "Utilities" menu. The "Edit User Tests" screen appears (see Figure 5-22).

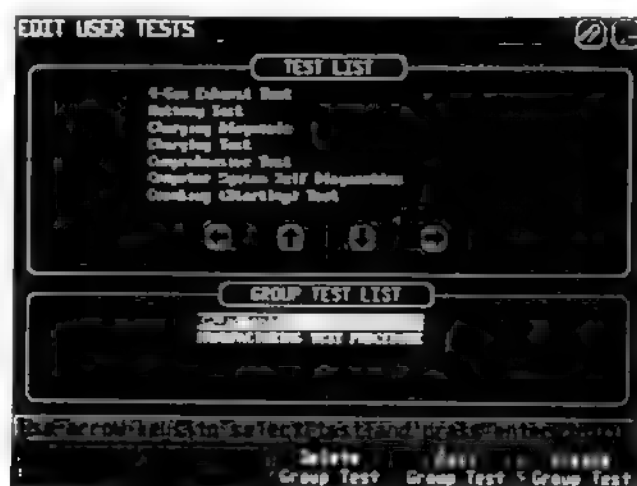


Figure 5-22

Press

- [F3] – to delete a group test from the 'User Test' menu.
- [F4] – to edit a group test from the "User Test" menu.
- [F5] – to create a new group test for the "User Test" menu.

Deleting a Group Test

From the "Edit User Tests" screen, use the Arrow Keys to highlight the group test to be deleted. Press [F3] to delete the group test.

Editing a Group Test

From the "Edit User Tests" screen, use the Arrow Keys to highlight the group test to be edited. Press [F4], the next "Edit Test" screen appears, (see Figure 5-23).

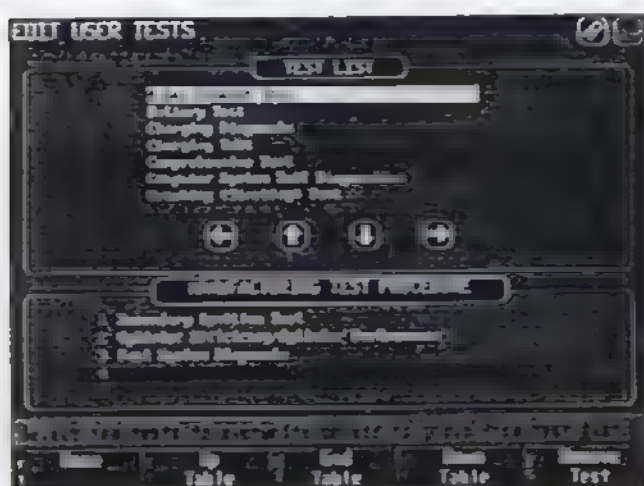


Figure 5-23

Press:

- [F1] – when finished editing the group test. The analyzer will prompt you to press [F1] again to save the changes or [F2] to return to the previous menu screen without saving any changes;
- [F2] – to move the group test cursor up the test list one line at a time;
- [F3] – to move the group test cursor to the end of the test list;
- [F4] – to move the group test cursor down the test list one line at a time;
- [F5] – remove an item from the group test list.

When finished, press [F10] to return to the "Utilities" menu.

Adding an Item to a Group Test

1. To add an item to the group test, press [F3] to move the cursor to the last line in the group test list.
2. Use the Arrow Keys to move the cursor up and down the items in the test list. Press [ENTER] at an item that you want to add to the group test.
3. Press [F1] when finished. The screen in Figure 5-24 appears prompting you to save or not save the additions.

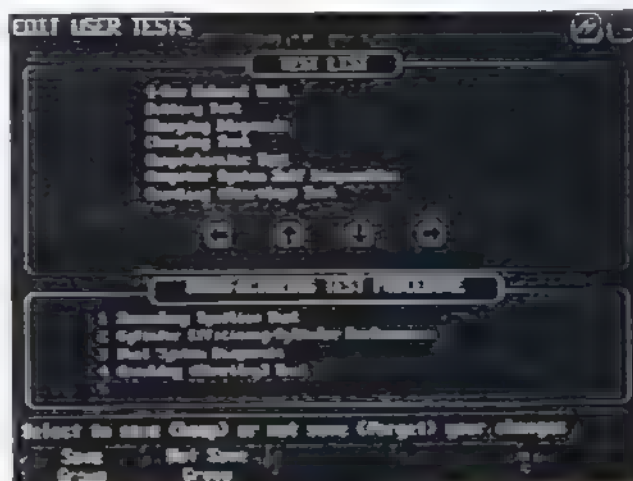


Figure 5-24

Press:

- [F1] – to save the group test;
- [F2] – to not save the changes made to the group test.

Deleting an Item in a Group Test

1. Press [F2], [F3] or [F4] to move the cursor to the item line in the group test list that you want to delete.
2. Press [F5] to remove the test
3. Press [F1] when finished. The screen in Figure 5-24 appears.

Press:

- [F1] – to save the group test;
- [F2] – to not save the changes made to the group test.

NOTE

The "Manufacturing Test Procedure" may be deleted, if desired.

Creating a New Group Test

1. From the "Edit User Tests" screen, press [F5]. A dialog box appears (see Figure 5-25).

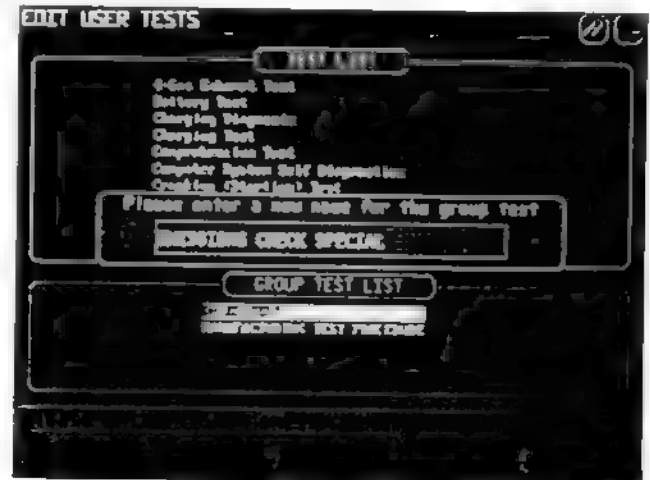


Figure 5-25

2. At the screen prompt type in the name of the new test and press [ENTER].
3. Use the Arrow Keys to move the test list cursor up and down the options in the test list. Press [ENTER] to add an item to the new group test.

NOTE

For best test performance, always place the options "Specification Entry" and "Customer Information" in the number 1 and 2 positions respectively, in any group test.

4. Add all test options for your custom test.
5. Press [F1] when finished. The screen in Figure 5-24 appears

Press

- [F1] – to save the group test;
- [F2] – to return to the previous menu screen without saving the group test

6. Press [F10] to return to the previous screen.

Save Test Data to Disk

Select this menu item to save the test results for the current customer to either a floppy disk drive or to the hard disk drive.

Saving Test Data to Hard Disk Drive

The analyzer software allows up to 1 megabyte of test records to be saved on the C: drive.

1. Select "Save Test Data to Disk" from the Utilities Menu.
2. Make sure the file location is at "C:".
3. Press [F2] to continue.
4. A summary screen of the record is displayed on the screen (see Figure 5-26). Press any key to continue.

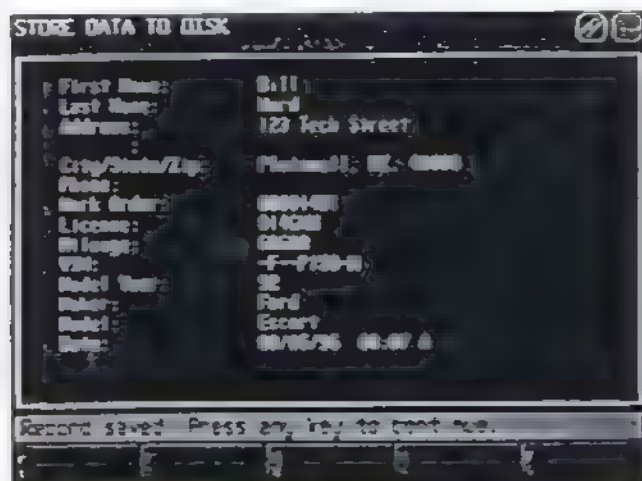


Figure 5-26

Saving Test Data to a Floppy Disk

1. Insert a disk in Drive A: and select "Save Test Data to Disk" from the Utilities menu.
2. Press [F5] to change disk location if necessary, (see Figure 5-27).



Figure 5-27

3. Follow the screen prompts and enter the correct drive and path for the records. Press [ENTER] to confirm the choices.
4. Press [F2] to copy the record to the diskette.
5. A summary screen of the record is displayed (see Figure 5-26). Press any key to continue.

NOTE For more information on disk drives and disk drive commands, consult an MS-DOS reference manual.

Retrieve Test Data From Disk

Select this menu item from the Utilities Menu to retrieve a customer test record from the disk drive where it is stored.

The "Retneve Data from Disk" screen will appear. The default drive to retneve data records from is "A:" (the floppy drive)

1. If you wish to change to a different drive, press [F5]. The analyzer will prompt you to enter a path. Type in the path command and press [ENTER].
2. The disk is read by the system and a screen appears with saved files (see Figure 5-28). Move the cursor to the desired record and press [ENTER].

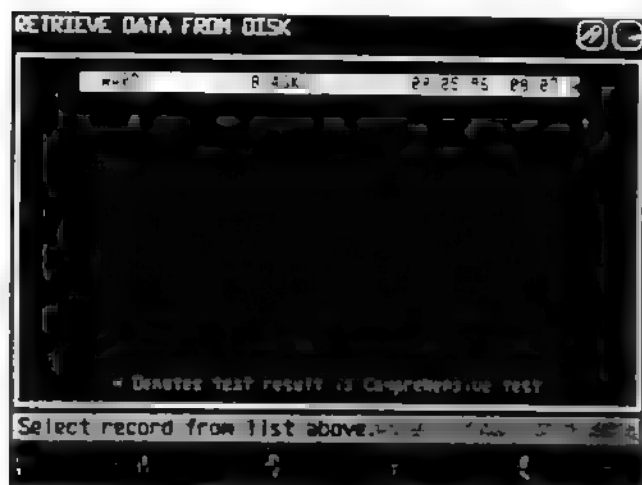


Figure 5-28

NOTE

If there are more than ten records on the disk, you will be asked to enter a customer name or vehicle license plate number (see Figure 5-29)

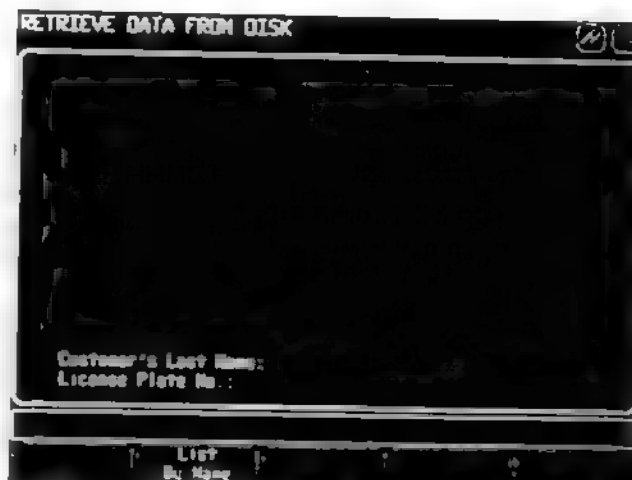


Figure 5-29

At this point, you may simply press [ENTER] and a list of customer names stored on the disk will be displayed (see Figure 5-30). The number to the right of each customer name denotes the number of test records stored on the disk under that name. Use the up- or down-arrow keys to highlight a customer name and press [ENTER].

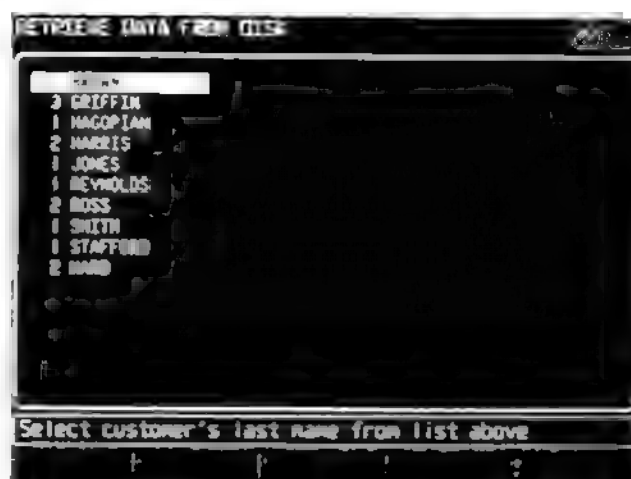


Figure 5-30

Alternatively, at the screen displayed in Figure 5-29, enter the customer's last name, or use the down-arrow key to highlight the license plate prompt and enter the vehicle's license plate number. Press [F2] to view a list of only those vehicle records associated with the customer name or vehicle license plate you selected (see Figure 5-31). Use the up- or down-arrow keys to highlight the test record you wish to retrieve and press [ENTER].

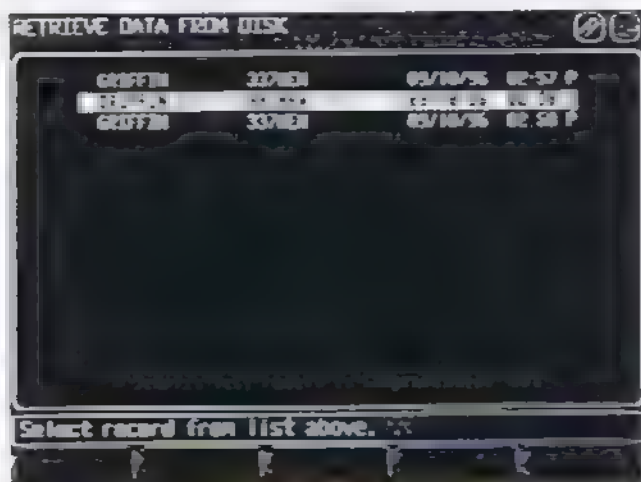


Figure 5-31

3. A summary screen of the record is displayed on the screen (see Figure 5-32).

Press:

- [F3] – to retrieve the record from the disk;
- [F4] – to delete the record from the disk;
- [F10] – to quit the screen without retrieving the file.

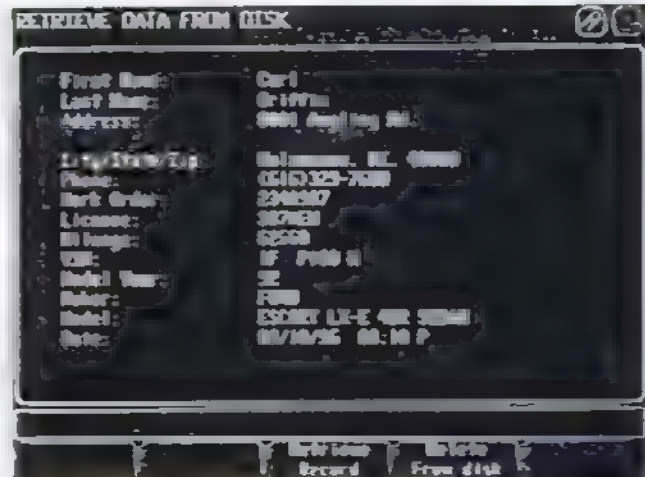


Figure 5-32

Specification Message

A specification message (see Figure 5-33) appears when the retrieved customer was last tested using a previous version of the 400 Series system software. The analyzer requests that the customer information and vehicle specifications be re-entered into memory.

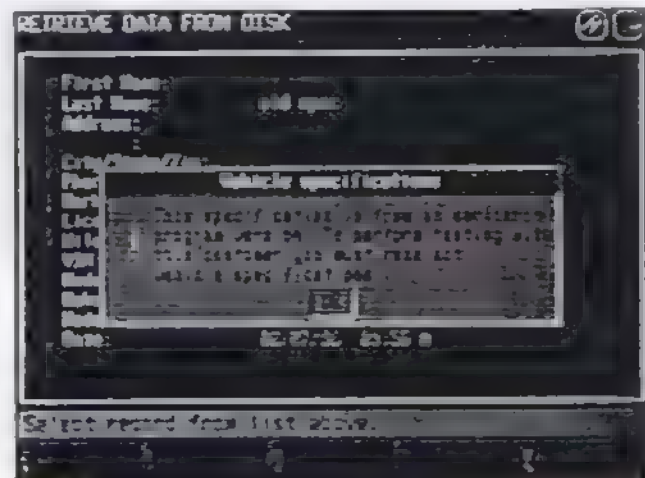


Figure 5-33

Press any key to clear the message. Re-enter specifications as required.

Software Security

Select this menu item from the Utilities Menu to view the security status of the programs installed on the analyzer (see Figure 5-34)



Figure 5-34

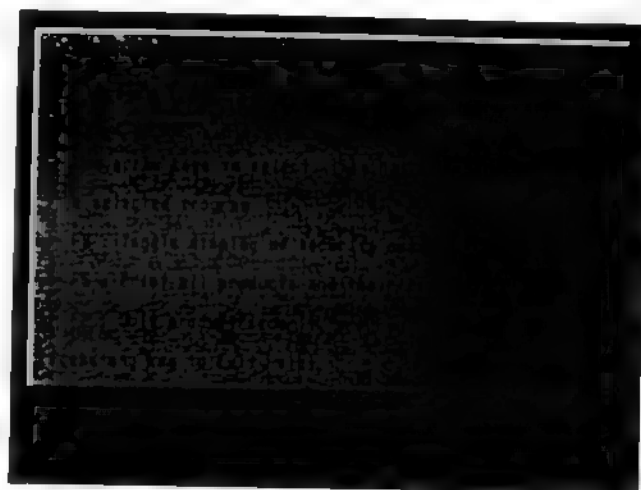


Figure 5-35

If you have only temporary authorization for a program module, a statement such as "56 More Authorized Runs Left" will be listed in the CURRENT STATUS column for that module.

Press:

- [F1] — for a help screen (see Figure 5-35);
- [F2] — to return to the menu system;
- [F3] — to display a security authorization request code;
- [F5] — to print a security authorization request form.

Notes:

Chapter 6

Maintenance

This section contains information for you, the owner and/or user, about how to properly care for your 400 Series Analyzer. Adherence to the suggested maintenance schedule will minimize the need for repairs over the life of your product.

Information is also included to help you repair/replace external sub-assemblies or leads and minimize the need for on-site service. If on-site service is required, information on how to contact Service is provided.

Troubleshooting

Preventive Maintenance Schedule

Weekly Maintenance

1. Check calibration gas bottle pressure. Replace bottle if gauge reads 20 PSI or less.
2. Inspect all cooling fan foam filters. Wash with soapy water and air dry
3. Inspect water trap/filter bowl. Wipe bowl with damp, soapy rag
4. Replace the secondary gas filter if it looks dirty. For best performance, replace both filters as a set. If desired, wash the mesh pre-filter in warm soapy water
5. Check the printer paper supply. Replace as necessary
6. Perform "Leak Check" and "Gas Calibration" procedures.

Monthly Maintenance

1. Inspect printout quality. Replace the ribbon if quality is poor.
2. Inspect casters for damage. Replace any broken casters immediately to prevent serious analyzer damage.
3. Clean and inspect all test leads, probes, hoses, etc. Contact an authorized service center for replacement leads if required.
4. Clean the outside surfaces of the cabinet with a non-abrasive household cleaner

Annual Maintenance

1. Contact Service for updates which may be available.

Software Problems

If experiencing software problems, print out a copy of the Diagnostic Report (see "Module Tests" and "Update Module Status Information" in Chapter 5) before calling an authorized service representative. The service representative will ask you to read back information from the diagnostic report before attempting to diagnose a problem

How to Obtain Service

If service is required on the analyzer, refer to the nearest authorized service center noted on the decal attached to rear of the analyzer, or call:

1-800-288-2327

or

1-800-833-3377

Warranty repairs will be considered only if proof of sale is presented to an authorized service center.

Gas Bottle Service

NOTE **IMPORTANT:** The gas values listed on any replacement bottle must match those on the old bottle. If they do not, call Service for bottle replacement.

Make sure that the bottles are installed correctly in the analyzer. The "Low Gas" bottle should be placed inside the left-hand bottle compartment, and the "High Gas" bottle should be placed in the right-hand compartment.

1. Turn gas bottle valve off (see Figure 6-1).
2. Loosen regulator nut and remove regulator assembly from bottle.
3. Place new bottle inside cabinet and install regulator assembly on new bottle. Tighten regulator nut with a wrench. Do not over-tighten the nut.

NOTE **REMEMBER:** Conserve calibration gas by turning the gas off after every gas calibration procedure!

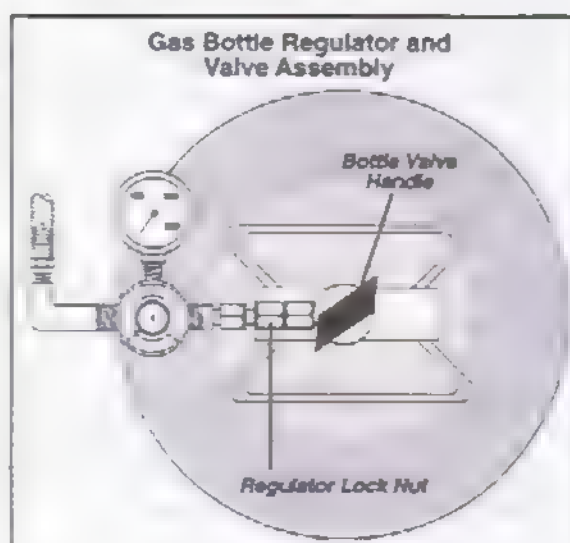


Figure 6-1

Filters

Exhaust Sample Filters

Your analyzer is equipped with one of two different types of exhaust gas sample filter assemblies. The following pages describe both types and give instructions for disassembling and cleaning or replacing filter elements for each type

Replace the exhaust sample filter whenever the filter looks dirty or whenever the screen displays the "LOW FLOW" message during calibration procedures. Sample filters are low-cost insurance to protect the analyzer. **DO NOT WAIT FOR "LOW FLOW" MESSAGE TO APPEAR - Change the filters whenever they look dirty.** (See next page for replacement procedure.)

NOTE

Always perform a leak check after you clean or replace any filters to verify proper sealing.

Tri-Filter Assembly (Figures 6-2 and 6-3)

The filter element should be replaced at least every two weeks, whenever the filter looks dirty, or whenever the screen displays the "Low Flow" message during calibration procedures.

Gas Bench Components

- A - Filter Housing Mounting Screws
- B - High Gas Port
- C - Low Gas Port
- D - Zero Air Inlet
- E - Sample Hose Connector Fitting
- F - Water Drain Hose
- G - Exhaust Gas Hose
- H - Oxygen Sensor
- I - O2 Sensor Wiring Connector

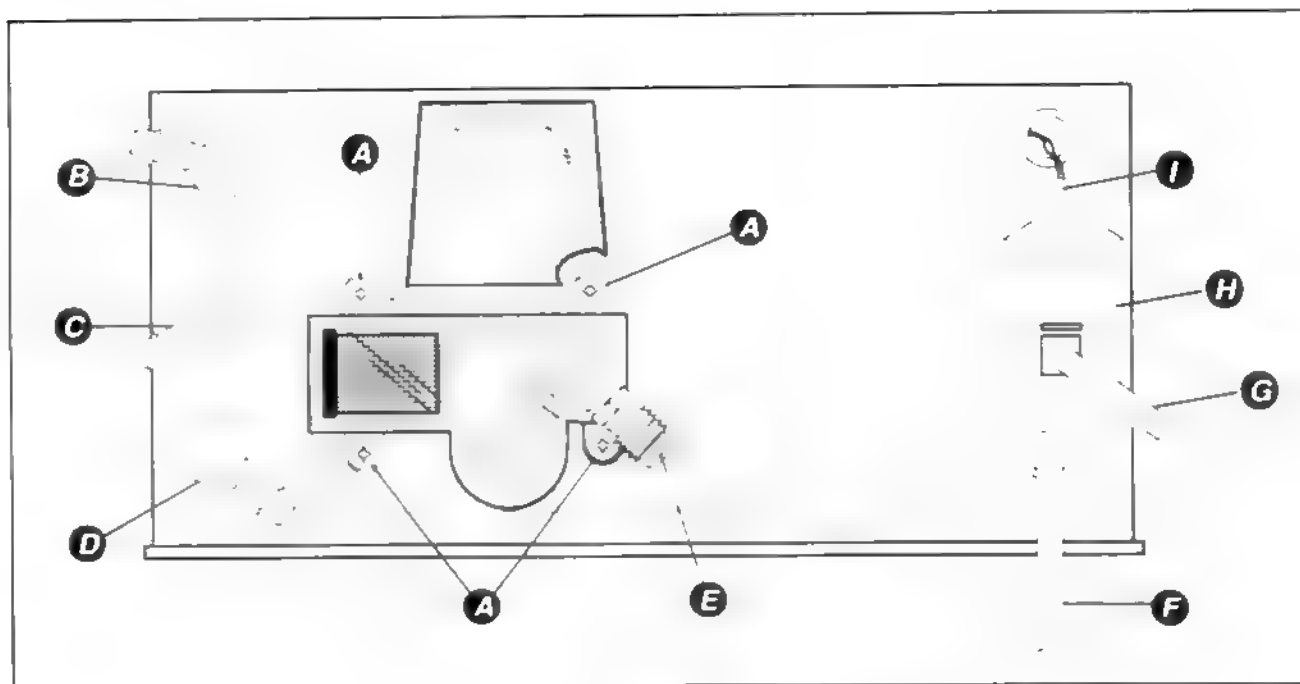


Figure 6-2

Tri-Filter Assembly Components

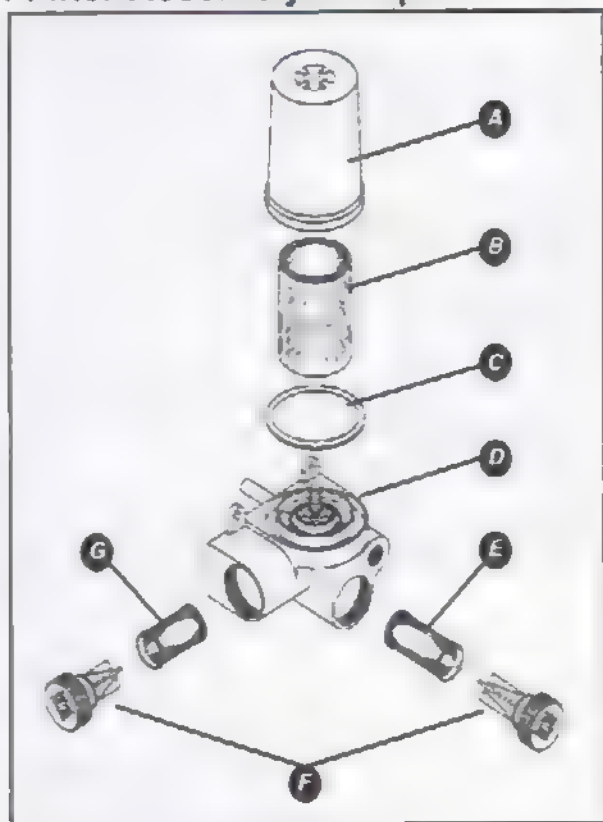


Figure 6-3

- A - Filter Bowl
- B - Filter Element
- C - Gasket, Filter Bowl
- D - Housing, Filter
- E - Water Screen Filter
- F - Filter Plug With O-ring
- G - Gas Screen Filter

Exhaust Sample Filter Replacement

1. To remove the filter housing from the bench, remove the four (4) screws (A) holding the filter housing in place (refer to Figure 6-2).
2. Insert a 3/8" ratchet drive into the recessed openings provided to remove the filter plugs or the filter bowl from the filter housing (refer to Figure 6-3, items A and F).
3. Pull the filters out of the housing.
4. Discard the secondary filter (see Figure 6-3, item B, the uppermost filter). The secondary filter is not washable.
5. Wipe out the filter bowl with a damp soapy rag.



Using a solvent to clean out the filter bowl will cause excessive HC hang-up to occur.

6. Clean the mesh filters (G) and (E) with warm soapy water, or, for best results, replace the filters.
7. Reassemble the filter housing. Hand tighten the upper bowl (A). Do not use a ratchet.

Water-Trap Filter Assembly

The second type of filter assembly is composed of a primary water-trap filter and a disposable secondary filter (see Figure 6-4). The primary filter can be cleaned and reused. Replace the secondary filter every two weeks or whenever the screen displays a "Low Flow" message during calibration. Sample filters are low-cost insurance to protect the analyzer — replace the secondary filter regularly.



Air flow in the secondary filter is from inside to outside. When the outside of the filter begins to change color, it is time to change the filter.



Failure to change the disposable (secondary) filter and clean the screen (primary) filter may damage your unit and void your warranty.

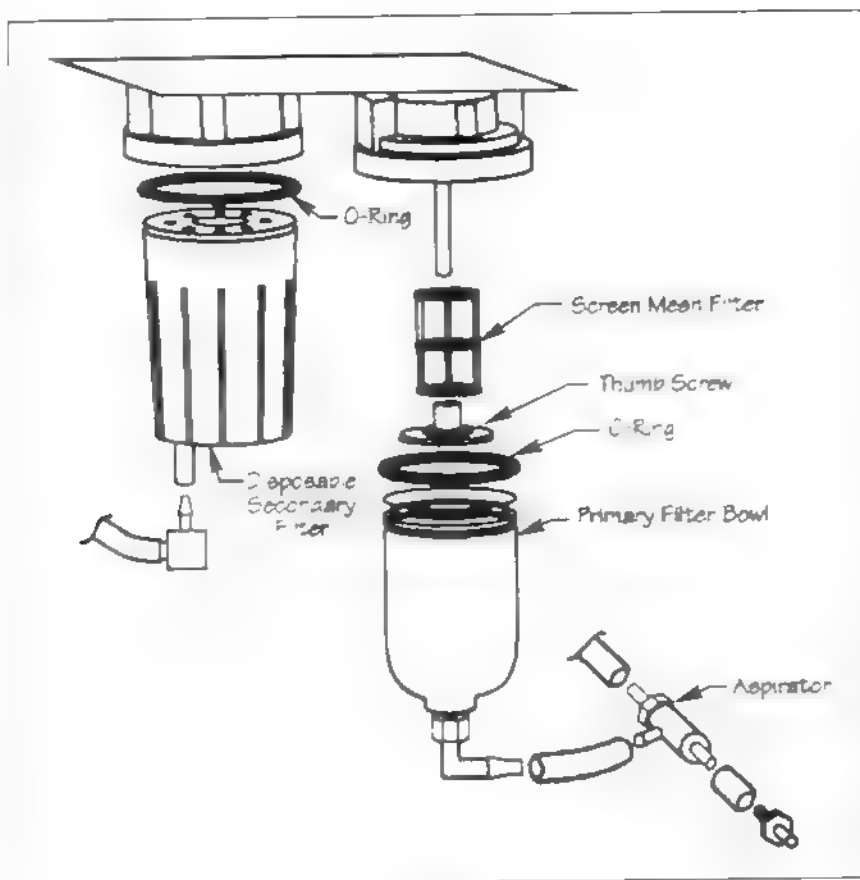


Figure 6-4

Chapter 6 - Maintenance

Water-Trap Filter Assembly—continued

Procedure — Cleaning the Primary Filter

1. Disconnect the plastic hose from the elbow on the bottom of the primary filter bowl (see Figure 6-4).
2. Unscrew and remove the clear plastic filter bowl.
3. Wipe the filter bowl with a damp soapy rag.

NOTE Using solvent to clean the filter bowl will cause HC contamination and may cloud the bowl.

4. Remove the plastic thumb screw and screen.
5. Wash the screen in warm soapy water, then rinse it thoroughly.
6. Reinstall the screen, thumb screw and filter bowl. Reattach the hose.

Procedure — Replacing the Secondary Filter

1. (see Figure 6-5) Gently pull the elbow (B) out of the tube on the bottom of the filter bowl assembly (A).
2. Unscrew the filter bowl assembly until it disengages. Discard the old assembly.
3. Install a new filter bowl assembly.

CAUTION Do **NOT** overtighten the filter bowl!

4. Firmly push the elbow up into the tube on the bottom of the new filter bowl.

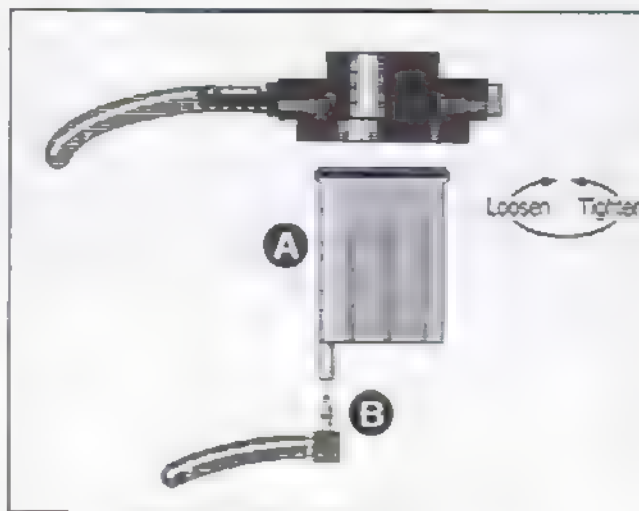


Figure 6-5

Cleaning the Aspirator

The aspirator removes excess fluid from the sample system. Inspect it once per week to make sure it is free of restrictions.

Procedure

1. Remove the hoses from the aspirator (see Figure 6-4).
 2. Unscrew the aspirator tip.
 3. Clean the aspirator and tip with warm soapy water until the metered passageways inside the aspirator are clean. Rinse thoroughly.
- CAUTION** The use of sharp instruments or wire to clean the passageways could damage the aspirator and render it inoperative!
4. Reassemble the aspirator and reconnect the hoses.

Cooling Fan Filter

Figure 6-6 shows the location of the analyzer module fan filter. Pry up one edge of the filter retainer and carefully snap the retainer off of the housing. Pull the foam filter out of the retainer and wash it in soapy water. Air dry the filter, insert the filter into the retainer and reinstall the retainer.

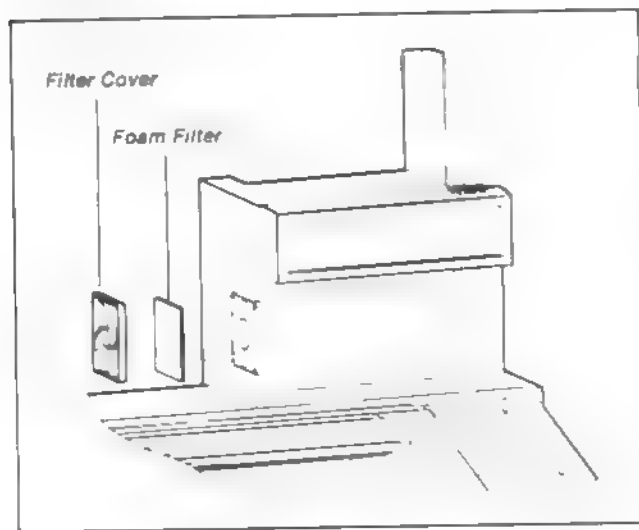


Figure 6-6

Fuse Replacement

Remove the fuse carrier with a flat bladed screwdriver.

120-Volt Operation

- 4.0 Amp 250V .25 X 1.25 Slow-Blow (Part Number 624-64594)

230-Volt Operation

- 5Amp, 5x20mm, Slo-Blo (Part Number 624-64594)

Printer Ribbon Removal (Okidata)

1. Open the printer cover.
2. Lift off the access cover.
3. Push the print head to the center of the carriage so it is away from the bail rollers. Make sure the bail is closed (lever back - see Figure 6-7).

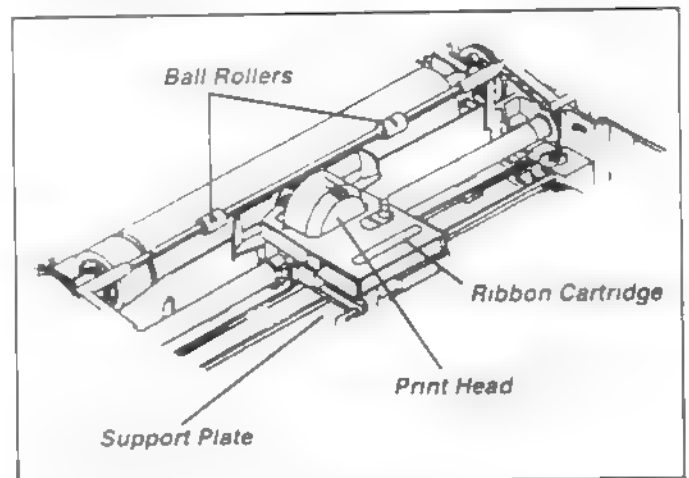


Figure 6-7

4. To remove the cartridge, slide the print head away from the rollers, grasp the cartridge on both sides and lift the cartridge off.

Printer Ribbon Replacement

NOTE Okidata printer cartridges for Model 380 are slightly different from cartridges used in the earlier Model's 182, 184, 192, and 320. The 380 cartridge is identical in size, but has a pair of small guide pins moulded into the bottom plastic housing next to the ribbon advance mechanism ratchet screw.

The correct ribbon cartridge part numbers for the printer models are:

| | |
|-----------|------------------------------|
| 696-98449 | Okidata 380 |
| 697-91076 | Okidata 182, 184, 192, & 320 |

1. With the knob facing up, tilt the ribbon cartridge onto the printhead plate so it slides into the area of the plate is closest to the front of the printer (see Figure 6-8).

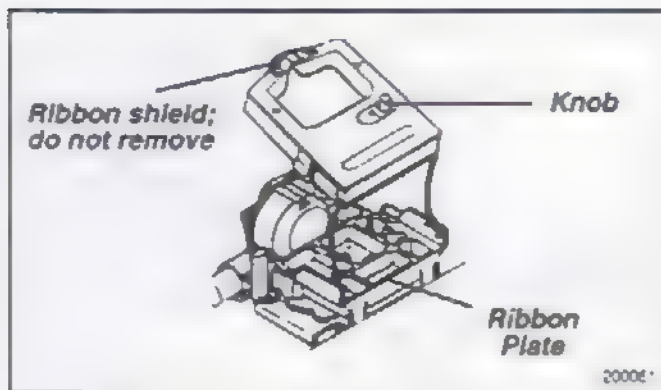


Figure 6-8

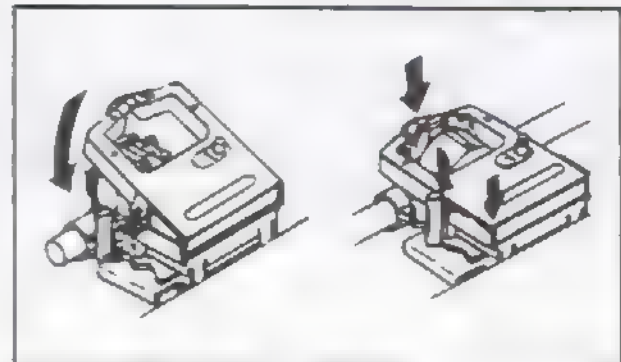


Figure 6-9

NOTE Do not remove the clear plastic ribbon shield from the ribbon cartridge.

3. Press on the cartridge until it snaps into place.
4. Turn the knob in the direction of the arrow to take up slack in the ribbon (see Figure 6-10).

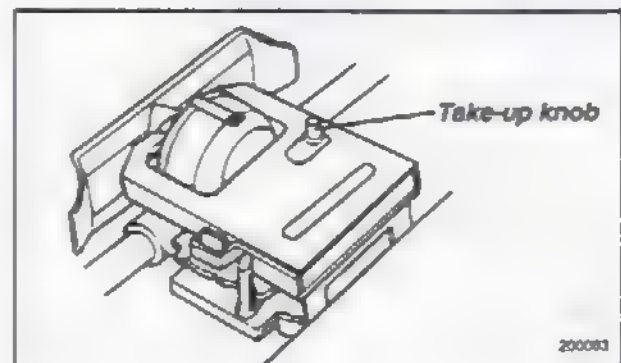


Figure 6-10

NOTE If the ribbon won't load easily, turn the blue knob slightly until the x-shaped notch on the bottom of the ribbon cartridge aligns with the x-shaped insert on the ribbon plate.

CAUTION Do NOT touch the printhead directly after printing. Allow five minutes for it to cool.

2. Lower the ribbon shield over the printhead, aligning the tabs with the inserts on the printhead plate (see Figure 6-9).

Vacuum / Pressure Transducer O-Ring

Your Analyzer is shipped with three O-rings. If the vacuum/pressure transducer develops a leak at the quick disconnect fittings, replace the O-rings inside the quick disconnect fittings

Use a dental pick or awl to pull the old O-ring out of the fitting and then slide a new ring into place.

General Cleaning

Video Display

Use a common household window cleaning solution. Clean with a soft damp cloth and light pressure

Analyzer Surfaces

Clean unit at least once a month; more often under dusty conditions. Use a cloth dampened with a mild dishwashing detergent and water mix



DO NOT use solvents containing petroleum distillates, or kerosene or gasoline. Static buildup on plastic surfaces can be reduced with anti-static sprays available at electronics supply stores.

Replacement Parts

| | Description | Part Number |
|----------------------|--|-------------|
| Leads | PROBE, RPM (#1 Green) | 534-00904 |
| | HARNESS, Secondary (High Tension) | 634-99983 |
| | HARNESS, Primary Cable | 617-99984 |
| | PROBE, Amp | 617-99982 |
| | PROBE, Low Current | 617-99817 |
| | ASSEMBLY, Vacuum Transducer | 517-00517 |
| | PROBE, Temperature | 534-00691 |
| | HARNESS, Volt/Ohms | 534-00501 |
| | HARNESS, Accessory Probe | 534-00904 |
| | ASSEMBLY, Timing Light | 617-88201 |
| | HARNESS, DIS Secondary | 634-99981 |
| | CLIP, Crocodile, Black | 651-96315 |
| | CLIP, Crocodile, Red | 651-96316 |
| | PROBE, Exhaust Gas Analyzer | 617-97041 |
| | END, Flexible, Sample Probe | 680-92442 |
| | CAP, Probe Tip | 697-85986 |
| | ASSEMBLY, Dual Pick-Up Hose | 617-97138 |
| | ADAPTER, Coil Wire | 634-98128 |
| | ADAPTER, H-Clip | 697-89427 |
| | ADAPTER, Toyota | 617-94158 |
| | ADAPTER, GM HEI | 617-66433 |
| | VACUUM TRANSDUCER FITTING | 817-00458 |
| Miscellaneous | FUSE, 4.0 Amp, Slow-Blow (2 Req'd) | 624-97430 |
| | GAS, Low Calibration CO/H ₂ /CO ₂ | 00045233 |
| | GAS, High Calibration CO/H ₂ /CO ₂ | 00045234 |
| | REGULATOR, Pressure, Calibration Gas | 697-97109 |
| | PLIERS, High Tension | 616-30238 |
| | TRI-FILTER, Gas | 597-00878 |
| | FILTER, Gas Screen | 597-00876 |
| | FILTER, Water Screen | 597-00877 |
| | FILTER, Water Trap | 00047470 |
| | FILTER, In-Line Disposable | 697-97146 |
| | FILTER, Air Cooling Fan | 617-89238 |
| | RIBBON, Printer, Okidata 182, 184, 192, 320 | 697-91076 |
| | RIBBON, Printer, Okidata 380 | 696-98449 |
| | PAPER, Printer (Box) | 697-97894 |

To Order Parts or Service:

To obtain a **Service Parts Catalog** illustrating and listing all available customer-serviceable parts for A.D. products, order part number 820-02878. To place an order for this catalog or for other parts, or to obtain Service on your products, call

1-800-288-2327

or

1-800-833-3377

Positive (red) Secondary Clip on Positive Polarity Cylinder

UNISCOPE

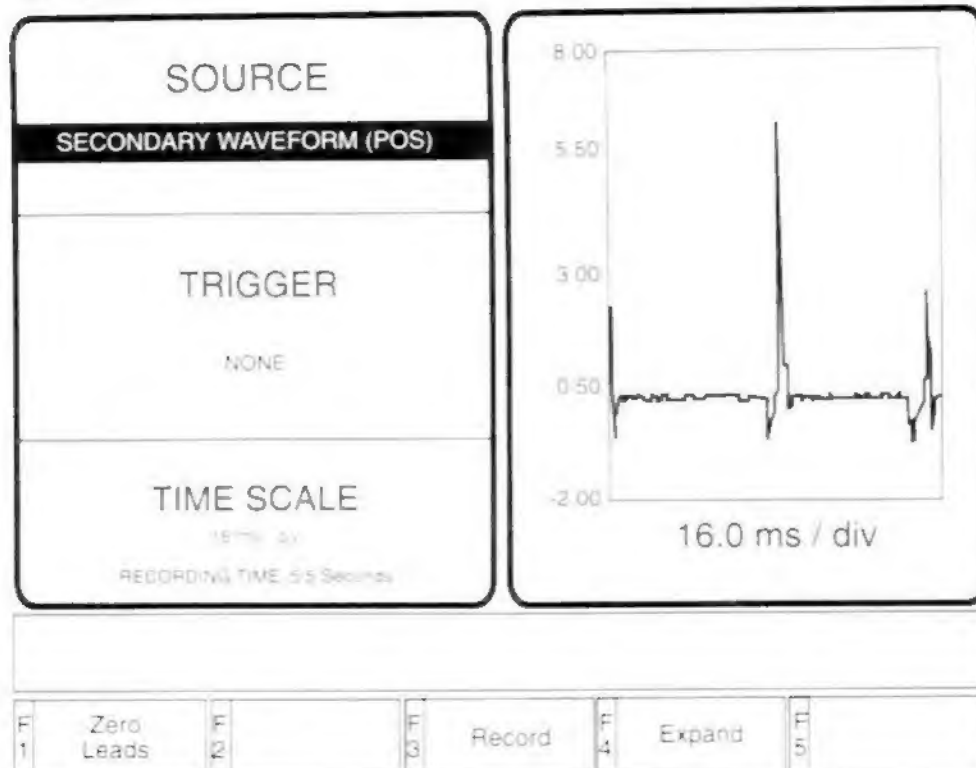


Figure 1

Positive (red) Secondary Clip on Negative Polarity Cylinder

UNISCOPE

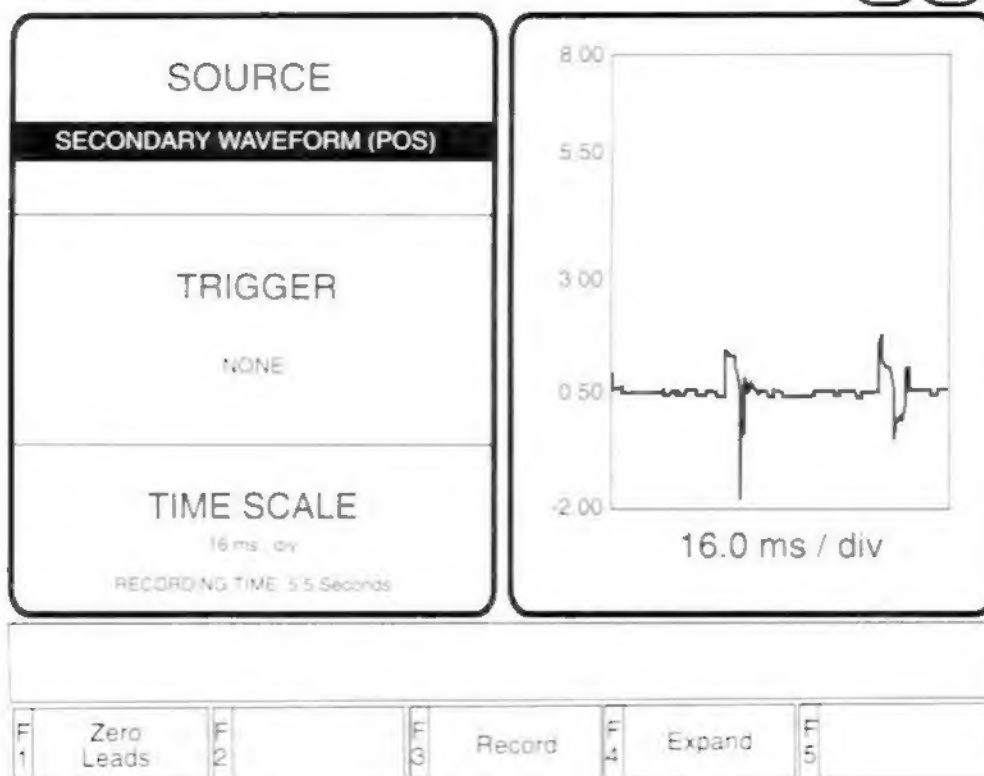


Figure 2

AUTOMOTIVE DIAGNOSTICS

A division of SPX Corporation

Technical Information — 400 Series Version 3.0 DIS Polarity Testing

(Addendum to Operator's Manual)

Over the course of the last several years, vehicle manufacturers have added many different DIS vehicles to their product lines. We make every effort to confirm our database information on all vehicles. You may on rare occasions encounter a vehicle that has different cylinder firing polarities from those found in our database. Please use the procedures below to determine the correct polarities.

NOTE For the following procedures, it is assumed that your 400 Series Analyzer is working properly and the display problems are caused by the test vehicle, or incorrect polarity programming, not lead failures. Handle and route leads carefully to avoid damage, and inspect and clean your lead sets daily to ensure long life and accurate signal inputs.

Procedure

Follow these steps if you are experiencing problems with Sync, Ignition signals or Cylinder Performance functions on a 400 Series Engine Analyzer.

Lead Status Check

Press [F7] to display the Lead Status screen and determine which input is **FAULTY**.

- **If the Green #1 signal is FAULTY**, perform the following while checking the lead status:
 - 1) Check for proper installation of the sync probe on the cylinder #1 ignition wire. If no problem is detected, proceed to Step 2.
 - 2) Install the Green #1 probe on a different spark plug wire to determine if cylinder #1 has a faulty ignition signal.
 - If the Green #1 probe displays "OK" there is a problem with cylinder #1 ignition components, for example, plug, wire, coil secondary, ignition module.
 - If the Green #1 probe still displays "FAULTY" try connecting to another ignition wire. If possible, connect to another known-good vehicle to verify unit is functioning properly.
- **If the Secondary signal is FAULTY**, proceed with the following steps.

- 1) Remove all Secondary clips.

- 2) Select **Multi-Analyzer Menu** from **Service Tools** menu.
- 3) Select **Uniscope** from **Multi-Analyzer** menu.
- 4) Select the following setup from the **Uniscope** menu:
 - a) **Source** = **SECONDARY WAVE FORM (POS)**
 - b) **Trigger** = **NONE**
 - c) **Time Scale** = **16 ms/div**
- 5) Verify and write down Firing Order of engine.
- 6) Install 1(one) **RED** Secondary clip on any spark plug wire.
- 7) Start engine, and determine polarity of KV spike displayed on Scope Display.

NOTE Please see Figures 1 and 2 on page two for spike polarity illustrations.

- 8) Record polarity of that cylinder.
 - 9) **To ensure personal safety, STOP ENGINE.**
 - 10) Move Secondary clip to each of the remaining plug wires in the firing sequence and determine polarity of each cylinder.
- NOTE** Remember to stop engine each time before moving secondary clip.
- 11) Edit specs of vehicle to match cylinder polarities as determined by this test process.
 - 12) Reconnect secondary clips to match the new polarity.

You have now completed the testing process.